Rosemount Analytical

MicroCEM TS

Analysis Enclosure

Micro Continuous Emission Monitor

Operation & Maintenance Manual

Revision 2.1, Oct. 13, 03

Part Number 1021021-100

Preface

Intended Use Statement 1
Safety Summary 1
Specifications – Analysis Enclosure: General 4
Specifications – Probe/Sample Handling Enclosure: General 5
Customer Service, Technical Assistance and Field Service 6
Returning Parts to the Factory 6
Training 7

1. Introduction 1–1
1.1 Overview 1–1
1.2 Time Shared Option 1–3
1.3 Theory of Operation 1–5
1.3.1 NOx 1–5
1.3.2 CO 1–5
1.3.3 O2 1–6
1.3.4 SO2 1–7

2. Detector Methodologies 2–1
2.1 Non-Dispersive Infrared (NDIR) 2–1
2.1.1 Interference Filter Correlation Method 2–1
2.1.2 Opto-Pneumatic Method 2–2
2.1.3 Overall NDIR Method 2–4
2.2 Paramagnetic Oxygen Method 2–5
2.3 Electrochemical Oxygen Method 2–6

3. Installation 3–1
3.1 Specifications 3–1
3.2 Process and Calibration Gas Connection 3–5
3.2.1 Gas Conditioning 3–6
3.3 Installation 3–1
3.3.1 Location 3–1
3.3.2 Limitations 3–1
3.3.3 Mounting Options 3–1
3.3.4 Electrical Connections 3–1
3.3.4.1 Circular Connector Assembly Instructions 3–2
3.3.4.2 EXT I/O Interface Connector 3–4
3.3.4.3 SHU #1 / #2 Interface Connector 3–6
3.3.4.4 COM Interface Connector 3–1
3.3.4.5 Lan Interface Connector 3–1
3.3.4.6 CPU I/O Interface Connector 3–1
3.3.4.7 SSU Power Connector, T/S units Only 3–2
3.3.4.8 AC Power Connector 3–2
3.3.5 Analytical Leak Check 3–3
3.3.5.1 Flow Indicator Method 3–1
3.3.5.2 Manometer Method 3–1
3.3.5.3 Troubleshooting Leaks 3–3

4. Startup and Operation 4–1
4.1 Startup Procedure 4–1
4.2 Analyzer Operation 4-1
4.2.1 User Interface 4-1
4.2.2 µCEM Main Window 4-2
4.2.3 µCEM Menus 4-4
4.2.4 µCEM Alarms 4-6

4.2.5 μCEM Login 4-8
4.2.6 μCEM Login-Current User Indication 4-9
4.2.7 Stream Switching Control 4-10
4.3 μCEM Settings 4-11
4.3.1 μCEM Settings-Range 4-11
4.3.2 μCEM Settings-Auto Calibration 4-13
4.3.3 μCEM Settings - Auto Calibration Time and Frequency 4-14
4.3.4 μCEM Settings-Limits 4-165
4.3.5 μCEM Settings-Calibration Gas 4-186
4.3.6 μCEM Settings-Maintenance Mode 4-18
4.3.7 μCEM Settings-Manual Calibration 4-1918
4.3.8 μCEM Settings-Auto Calibration Dialog 4-1519
4.4 μCEM Administration 4-2
4.4.1 μCEM Administration-User Settings 4-2
4.4.2 μCEM Administration-Auto Logoff 4-3
4.5 μCEM Factory and User Settings 4-4
4.6 uCEM Data Logs 4-7
4.6.1 Maximum Log File Size 4-7
4.6.2 Maximum Number of Log Files 4-7
4.6.3 Log File Name Format 4-7
4.6.4 Measurement Log File Format 4-8
4.6.5 Calibration Log File Format 4-8
4.6.6 Alarm Log File Format 4-10
4.6.7 Accessing the Real-Time ACSII Data String via Ethernet TCP/IP (DAS) 4-101
4.7 Viewing μCEM Data and Diagnotics with the Pocket PC Web Browser 4-1
4.8 Viewing μCEM Data with a Web Browser 4-1
4.8.1 Real-Time Page 4-1
4.8.2 Emissions Page 4-3
4.8.3 Download Page 4-6
4.9 Viewing μCEM Data with MS Excel 4-7
4.10 Auto Calibration 4-1

5. Maintenance and Service 5-1

5.1 Overview 5-1
5.2 Converter 5-3
5.3 Ozonator 5-3
5.4 Personality Modules 5-3
5.5 Detector Assembly 5-5
5.6 Central Processing Unit 5-8
5.6.1.1 Features 5-8
5.6.1.2 EMBEDDED ENHANCED BIOS: 5-9
5.6.2 Analog/Digital I/O Board 5-9
5.6.2.1 Automatic Calibration 5-10
5.6.2.2 Analog Inputs 5-10
5.6.2.3 Programmable Input Ranges 5-11
5.6.2.4 Enhanced Trigger and Sampling Control Signals 5-11
5.6.2.5 Analog Outputs 5-11
5.6.2.6 FIFO and 16-Bit Bus Interface 5-11
5.6.2.7 Specifications 5-12
5.6.3 PCMCIA Adapter 5-13
5.6.3.1 Features 5-14
5.6.3.2 SOFTWARE FEATURES: 5-14
5.6.4 Modem 5-14

5.6.4.1 Features 5-15
5.6.5 Flash Drive 5-1
5.6.5.1 Specifications 5-1
5.6.6 Pocket PC 5-1
5.6.7 Wireless LAN Adapter 5-2
5.6.8 500 Watts Power Supply 5-3
5.6.8.1 FEATURES 5-3
5.7 Replacement Parts 5-4
5.7.1 Replacement Part list 5-4
5.8 System Enclosure 5-9
5.9 Trouble LED 5-10

6. µCEM Software 6-1

6.1 µCEM User Interface Software 6-1
6.2 µCEM Web Server Software 6-1
6.3 Software Development Management 6-2
6.4 µCEM Pocket PC Connection Failure 6-3

PREFACE

INTENDED USE STATEMENT

The µCEM Continuous Emission Monitoring Gas Analyzer is intended for use as an industrial process measurement device only. It is not intended for use in medical, diagnostic, or life support applications, and no independent agency certifications or approvals are to be implied as covering such applications.

SAFETY SUMMARY

DANGER is used to indicate the presence of a hazard which **will** cause **severe** personal injury, death, or substantial property damage if the warning is ignored.

WARNING is used to indicate the presence of a hazard which **can** cause **severe** personal injury, death, or substantial property damage if the warning is ignored.

CAUTION is used to indicate the presence of a hazard which will or can cause minor personal injury or property damage if the warning is ignored.

NOTE IS USED TO INDICATE INSTALLATION, OPERATION, OR MAINTENANCE INFORMATION WHICH IS IMPORTANT BUT NOT HAZARD RELATED.

DANGER: ALL PERSONNEL AUTHORIZED TO INSTALL, OPERATE AND SERVICE THIS EQUIPMENT

To avoid explosion, loss of life, personal injury and damage to this equipment and on-site property, do not operate or service this instrument before reading and understanding this instruction manual and receiving appropriate training. Save these instructions.

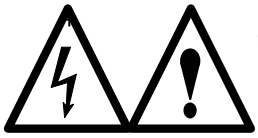
If this equipment is used in a manner not specified in these instructions, protective systems may be impaired.

WARNING: DEVICE CERTIFICATION(S)

Any addition, substitution, or replacement of components installed on or in this device, must be certified to meet the hazardous area classification that the device was certified to prior to any such component addition, substitution, or replacement. In addition, the installation of such device or devices must meet the requirements specified and defined by the hazardous area classification of the unmodified device. Any modifications to the device not meeting these requirements, will void the product certification(s).

DANGER: TOXIC GAS

This device may contain explosive, toxic or unhealthy gas components. Before cleaning or changing parts in the gas paths, purge the gas lines with ambient air or nitrogen.



WARNING: ELECTRICAL SHOCK HAZARD
POSSIBLE EXPLOSION HAZARD

Do not open while energized. Do not operate without dome and covers secure. Installation requires access to live parts which can cause death or serious injury.

WARNING: ELECTRICAL SHOCK HAZARD

For safety and proper performance this instrument must be connected to a properly grounded three-wire source of power.

WARNING: POSSIBLE EXPLOSION HAZARD

Ensure that all gas connections are made as labeled and are leak free. Improper gas connections could result in explosion and death.

WARNING: TOXIC GAS

This unit's exhaust may contain hydrocarbons and other toxic gases such as carbon monoxide. Carbon monoxide is highly toxic and can cause headache, nausea, loss of consciousness, and death.

Avoid inhalation of the exhaust gases at the exhaust fitting.

Connect exhaust outlet to a safe vent using stainless steel or Teflon line. Check vent line and connections for leakage.

Keep all tube fittings tight to avoid leaks. See Section 3.3.5 for leak test information.

WARNING: PARTS INTEGRITY AND UPGRADES

Tampering with or unauthorized substitution of components may adversely affect the safety of this instrument. Use only factory approved components for repair.

Because of the danger of introducing additional hazards, do not perform any unauthorized modification to this instrument.

Return the instrument to a Rosemount Analytical Service office for service or repair to ensure that safety features are maintained.

CAUTION: PRESSURIZED GAS

This unit requires periodic calibration with a known standard gas. It also may utilize a pressurized carrier gas, such as helium, hydrogen, or nitrogen. See General Precautions for Handling and Storing High Pressure Gas Cylinders at the rear of this manual.

CAUTION: HEAVY WEIGHT

USE TWO PERSONS OR A SUITABLE LIFTING DEVICE TO MOVE OR CARRY THE INSTRUMENT.

SPECIFICATIONS - GENERAL

SPECIFICATIONS – Analysis Enclosure: GENERAL

Power: Universal Power Supply 85 – 125 VAC, 50 – 60 Hz, ± 10%, 1000 Watts Maximum at Start Up. 500 Watts Nominal

MicroProcessor: Intel Celeron processor, 566MHz, 64MB RAM, PC/104 architecture, Windows NT embedded Platform

Pocket PC: 206MHz, StrongArm processor, 32MB RAM 32 ROM, 240 X 320 pixels LCD, TFT color, backlit, Wireless LAN optional

Detectors//Number: NDIR (CO), UV (SO2), Paramagnetic (O2), Electrochemical (O2), Chemiluminscent (NOx) // Up to three in one analyzer

Mounting: Wall Mount

Area Classification: General Purpose / NEMA 4X Fiberglass Enclosure Compliant

Compliance's: CSA (Pending)

Ambient Temperature Range: -30^0 to 50^0 Celsius.

Relative Humidity: 5 to 99%

Inputs/Outputs: The complete I/O list with terminal locations is located in section 3.3.4

Digital:

RS-485 Serial Port. (Multi-Drop Network)

RS-232 Serial Port.

LAN, Ethernet 10/100-BaseT

Connectivity Protocols:

HTML (Web Browser) – Status, file transfer Modem / Web browser

TCP/IP, MTTP ASCII String

Microsoft Shared drive

FTP Logs download

TELNET Server

Analog:

Analog Outputs: Qty. 3 Isolated 4-20 mA dc, 500 ohms Max Load (O2, CO or SO2, NOx)

*Optional: Additional Qty. 3 (Extended I/O option)

Analog Inputs: Qty 2 (Typically; MW, Fuel Flow)

*Optional: Additional Qty. 2 (Extended I/O option)

Digital

Outputs:

Following are connected directly to the MicroCEM Probe/Sample Handling Box: Sample Pump on/off, Drain Pump on/off, Purge on/off, Calibrate on/off – *All are rated 110VAC @ 1amp Dry Contact.*

Qty. 6 digital Outputs - TTL: 5 VDC Max Current 20 mA

**Optional Time Share option – Dry Contact used for Stream Indicator.*

Digital Inputs:

Qty. 3: (Typical Process on/off, Flame Detect, Shutdown or Initiate Cal)

*Optional three additional Inputs (Extended I/O)

Instrument Weight: 62 lbs Typical

Size: 24“ X 20“ X 12“ (H W D)

Ranges:

O2: 0 –2 Selectable to 0 –25% (1% increments)

CO: 0 –100ppm Selectable to 1000ppm (1ppm increments)

NOx: 0 – 10ppm Selectable to 1000ppm (1ppm increments)

Sample Temperature: 0 degrees C to 55 degrees C

Sample flow rate: .5 to 1.5 liters/min

Warm Up Time: Max 25 minutes @ low ambient temperatures

	Paramagnetic O_2)	**Electro Chemical O_2**	**NDIR CO**	**Chemiluminescent NOx**
Linearity	<+/- 1%	< +/- 1%	< +/- 1%	< +/- 1% (1)
Zero Drift	< +/- 1% /day	< +/- 1% /day	< +/- 1% /day	< +/- 1% /day (1)
Span Drift	< +/- 1% /day	< +/- 1% /day	< +/- 1% /day	< +/- 1% /day (1)
Repeatability	< +/- 1%	< +/- 1%	< +/- 1%	< +/- 1%/day (1)
Response Time (t_{90})	10< +/-t_{90}< +/-15	10< +/-t_{90}< +/-15	15s< +/-t_{90}< +/-30s	15s< +/-t_{90}< +/-30s
Influence of Ambient Temperature (-20C to 45C)				
-On Zero	< +/-1%	< +/-1%	< +/-2%	< +/-2%
-On Span	< +/-1%	< +/-1%	< +/-2%	< +/-2%

(1) 0-10ppm NOx range is <+/- 3%.

SPECIFICATIONS – Probe/Sample Handling Enclosure: GENERAL

Power: Universal Power Supply 85 – 125 VAC, 50 – 60 Hz, ± 10%
750 Watts Maximum at Start Up. 500 Watts Nominal

Mounting: Customer Flange Mount (2 Hole Top) or Wall Mount for High Temp Option

Area Classification: General Purpose / NEMA 4X Fiberglass Enclosure

Compliance's: CSA (Pending)

Ambient Range Temperature: -30^0 to 50^0 Celsius

Relative Hum: 5 to 99%

Instrument Weight: 95 lbs Typical

Size: 24“ X 34“ X 12“ (H W D)

Stack Sample Moisture: Up to 25% max

Sample Cooler: Thermo Electric dual pass Chiller. Permeation Tube (-30 degrees C. Dewpoint. Customer instrument air required @ 5 L/M, -40 degree C dewpoint

Max. Stack Temperature: Standard 400^0 F.
Optional: 600 F (available with elongated spool option)
High Temp: 1400 F (Off Stack Option)

Stack Pressure: Typical -5 to 15 inches H_2O

Sample Flow Rate: 500 to 2500cc/min

Response Time: Maximum distance between Analysis Enclosure and Sample Conditioning/Probe Enclosure is 300'. (Response time is 30 seconds/100' w/1/4" tubing)..

Probe Length: 48" length 316 SS Probe with .5 micron sintered filter. Customer to cut to length in field if necessary. Optional 5’ and 6’ probes.

Mounting Flange: Standard 4“ 150# Raised Face. Shipped Equipped with Gasket

Sample Pump: 316 SS diaphragm type

Instrument Air Requirements: Instrument grade air required. 15 SCFM @ 60 -100 PSIG (30 seconds 2 times per day) Pressure Regulation by Customer

CUSTOMER SERVICE, TECHNICAL ASSISTANCE AND FIELD SERVICE

For order administration, replacement parts, application assistance, on-site or factory repair, service or maintenance contract information, contact:

Rosemount Analytical Inc.
Process Analytical Division
Customer Service Center
1-800-433-6076

RETURNING PARTS TO THE FACTORY

Before returning parts, contact the Customer Service Center and request a Returned Materials Authorization (RMA) number. Please have the following information when you

call: *Model Number, Serial Number, and Purchase Order Number or Sales Order Number.*

Prior authorization by the factory must be obtained before returned materials will be accepted. Unauthorized returns will be returned to the sender, freight collect.

When returning any product or component that has been exposed to a toxic, corrosive or other hazardous material or used in such a hazardous environment, the user must attach an appropriate Material Safety Data Sheet (M.S.D.S.) or a written certification that the material has been decontaminated, disinfected and/or detoxified.

Return to:

Rosemount Analytical Inc.
1201 North Main St.
Orrville, OH 44667
USA

TRAINING

A comprehensive Factory Training Program of operator and service classes is available. For a copy of the *Current Operator and Service Training Schedule* contact the Technical Services Department at:

Rosemount Analytical Inc.
Phone: 1-330-682-9010

COMPLIANCES

This product may carry approvals from several certifying agencies. The certification marks appear on the product name-rating plate.

NOTES

1. Introduction

1.1 Overview

This manual describes the Rosemount Analytical Micro Continuous Emission Monitoring (µCEM) gas Analyzer Module.

The µCEM Analyzer Module is designed to continuously determine the concentration of O2, CO, SO2, and NOx in a flowing gaseous mixture. The concentration is expressed in percent or parts-per-million.

The sampled gas is collected from the stack and prepared by the Probe/Sample Handling Enclosure for analysis and processing by the Analysis Enclosure. The ANALYSIS ENCLOSURE is a stand alone, computer-controlled unit, utilizing PC/104 as the system bus. The uCEM is enclosed in rugged NEMA 4X, IP65 type enclosures, for harsh environment. The ANALYSIS ENCLOSURE utilizes convection cooling with no air intake and air vents. The ANALYSIS ENCLOSURE is modular, general purpose and easily expandable. It utilizes industry standard components such as PC/104 boards, and modular signal conditioning modules.

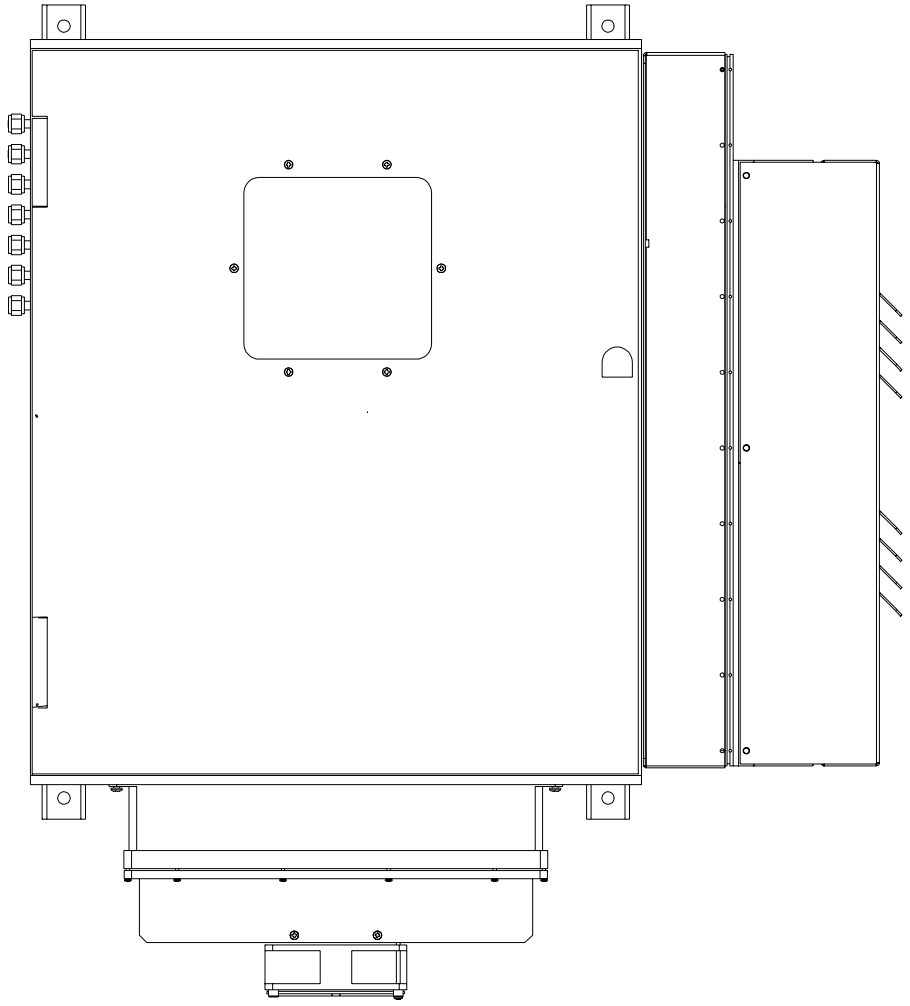


Figure 1-1. µCEM Micro Continuous Emission Monitoring – Analysis Enclosure

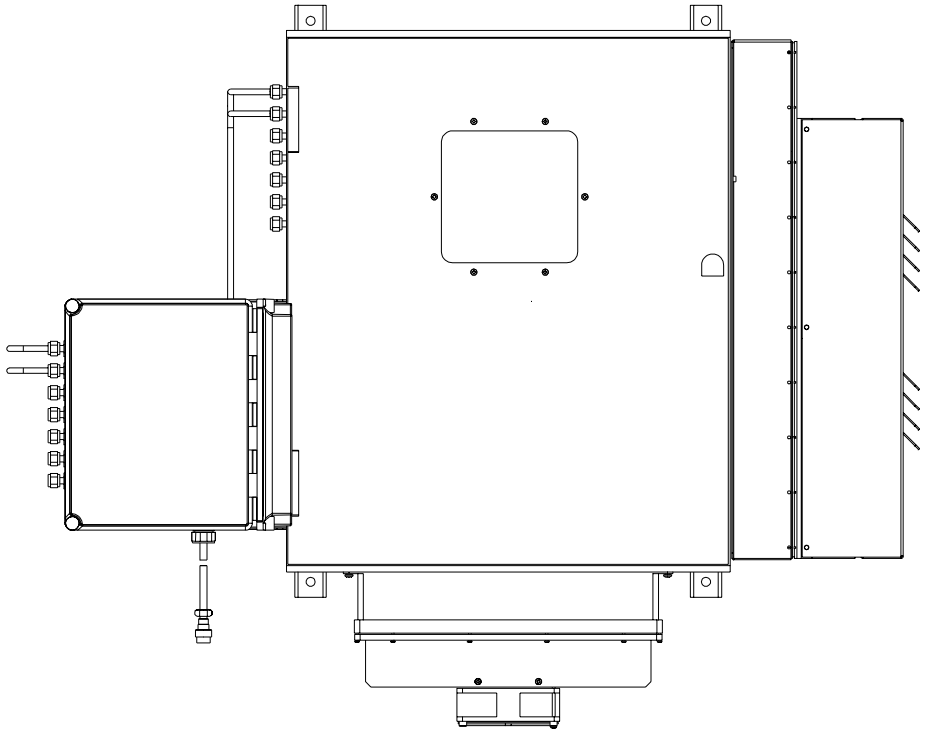


Figure 1-2. µCEM Micro Continuous Emission Monitoring Gas Analyzer with Time Share option.

1.2 Time Shared Option

Provides the functionality to monitor and process sample gases from two streams on a time-share scheme. This option allows you to connect one uCEM to two Sample Handling units.

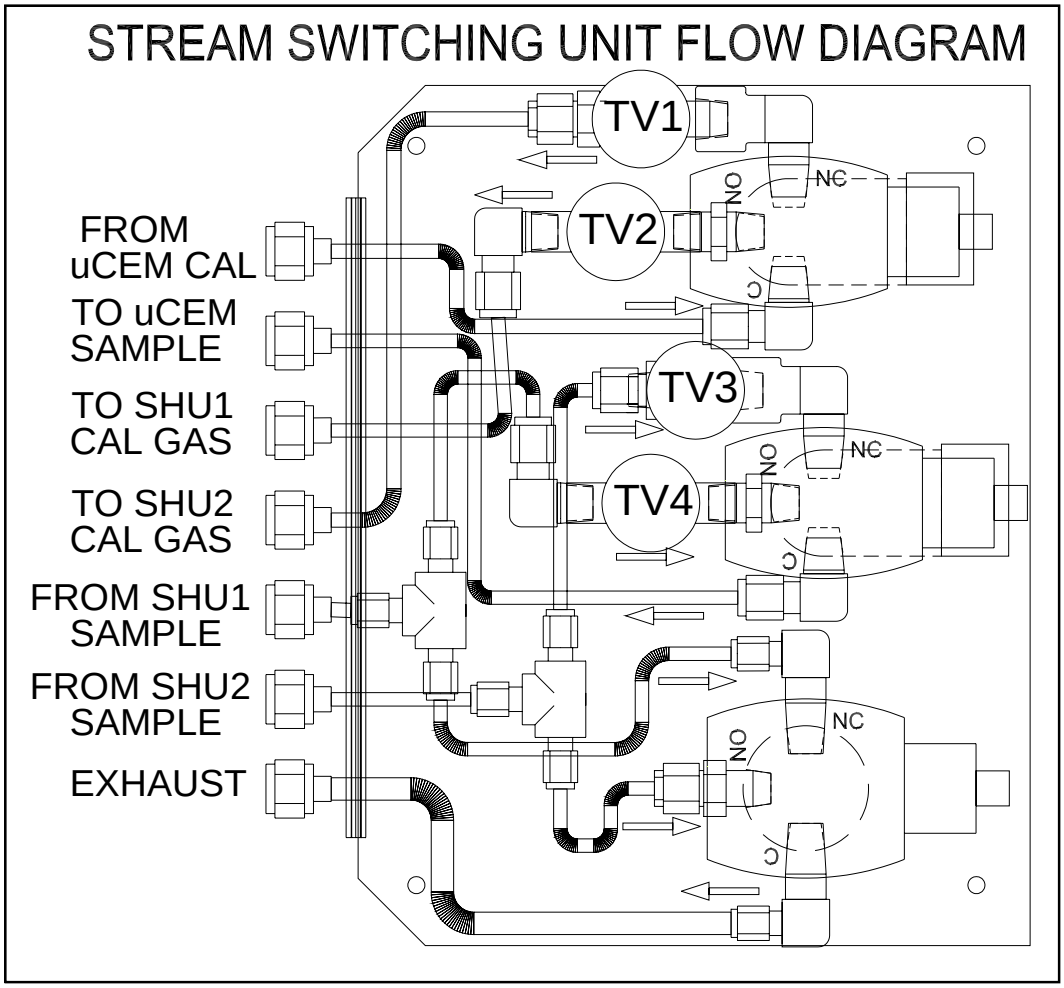


Figure 1-3. Time Share option Flow Diagram

1.3 Theory of Operation

1.3.1 NOx

The NOx analyzer continuously analyzes a flowing gas sample for NOx [nitric oxide (NO) plus nitrogen dioxide (NO_2)]. The sum of the concentrations is continuously reported as NOx.

The µCEM NOx Analyzer Module uses the chemiluminecence method of detection. This technology is based on NO's reaction with ozone (O_3) to produce NO_2 and oxygen (O_2). Some of the NO_2 molecules produced are in an electronically excited state (NO_2* where the * refers to the excitation). These revert to the ground state, with emission of photons (essentially, red light). The reactions involved are:

$$NO_2 + O_3 \rightarrow NO_2^* + O_2$$

$$NO_2^* \rightarrow NO_2 + \text{red light}$$

The sample is continuously passed through a heated bed of vitreous carbon, in which NO_2 is reduced to NO. Any NO initially present in the sample passes through the converter unchanged, and any NO_2 is converted to an approximately equivalent (95%) amount of NO.

The NO is quantitatively converted to NO_2 by gas-phase oxidation with molecular ozone produced within the analyzer from air supplied by an external source. During the reaction, approximately 10% of the NO_2 molecules are elevated to an electronically excited state, followed by immediate decay to the non-excited state, accompanied by emission of photons. These photons are detected by a photomultiplier tube which produces an output proportional to the concentration of NOx in the sample.

To minimize system response time, an internal sample bypass feature provides high-velocity sample flow through the analyzer.

1.3.2 CO

The optical bench can selectively measure multiple components in a compact design by using a unique dual optical bench design. Depending on the application, any two combinations of NDIR channels can be combined on a single chopper motor/dual source assembly.

Other application-dependent options include a wide range of sample cell materials, optical filters and solid state detectors. The NDIR Microflow detector consists of two chambers, measurement and reference with an interconnected path in which an ultra low flow filament sensor is mounted. During operation, a pulsating flow occurs between the two chambers which is dependent upon: sample gas absorption, modulation by the chopper motor and the fill gas of the detector chambers. The gas flow/sensor output is proportional to the measured gas concentration. The optical bench is further enhanced by a novel "Look-through" detector technique. This design allows two detectors to be arranged in series --- enabling two different components to be measured on a single optical bench. The optical bench contains a unique eddy current drive chopper motor and source assembly. This design incorporates on board "intelligence" to provide continuous "self test" diagnostics.

1.3.3 O2

Paramagnetic: The determination of oxygen is based on the measurement of the magnetic susceptibility of the sample gas. Oxygen is strongly paramagnetic, while other common gases are not. The detector used is compact, has fast response and a wide dynamic range. The long life cell is corrosion resistant, heated and may be easily cleaned. It has rugged self-tensioning suspension and is of welded Non-Glued construction.

1.3.4 SO2

The optical bench can selectively measure multiple components in a compact design by using a unique dual optical bench design. Depending on the application, any two combinations of NDIR channels can be combined on a single chopper motor/dual source assembly.

Other application-dependent options include a wide range of sample cell materials, optical filters and solid state detectors. The NDIR Microflow detector consists of two chambers, measurement and reference with an interconnected path in which an ultra low flow filament sensor is mounted during operation, a pulsating flow occurs between the two chambers which is dependent upon: sample gas absorption, modulation by the chopper motor and the fill gas of the detector chambers. The gas flow/sensor output is proportional to the measured gas concentration. The optical bench is further enhanced by a novel “Look-through” detector technique. This design allows two detectors to be arranged in series --- enabling two different components to be measured on a single optical bench. The optical bench contains a unique eddy current drive chopper motor and source assembly. This design incorporates on board “intelligence” to provide continuous “self test” diagnostics.

2. Detector Methodologies

The µCEM can employ up to three different measuring methods depending on the configuration chosen. The methods are: NDIR CO/SO2, Paramagnetic O_2, Electrochemical O_2, and chemiluminescent NOx.

2.1 Non-Dispersive Infrared (NDIR)

The non-dispersive infrared method is based on the principle of absorption of infrared radiation by the sample gas being measured. The gas-specific wavelengths of the absorption bands characterize the type of gas while the strength of the absorption gives a measure of the concentration of the gas component being measured.

An optical bench is employed comprising an infrared light source, two analysis cells (reference and measurement), a chopper wheel to alternate the radiation intensity between the reference and measurement side, and a photometer detector. The detector signal thus alternates between concentration dependent and concentration independent values. The difference between the two is a reliable measure of the concentration of the absorbing gas component.

Depending on the gas being measured and its concentration, one of two different measuring methods may be used as follows:

2.1.1 Interference Filter Correlation Method

With the IFC method the analysis cell is alternately illuminated with filtered infrared concentrated in one of two spectrally separated wavelength ranges. One of these two wavelength bands is chosen to coincide with an absorption band of the sample gas and the other is chosen such that none of the gas constituents expected to be encountered in practice absorbs anywhere within the band.

The spectral transmittance curves of the interference filters used in the µCEM analyzer and the spectral absorption of the gases CO and CO_2 are shown in Figure 2-1 below. It can be seen that the absorption bands of these gases each coincide with the passbands of one of the interference filters. The forth interference filter, used for generating a reference signal, has its passband in a spectral region where none of these gases absorb. Most of the other gases of interest also do not absorb within the passband of this reference filter.

The signal generation is accomplished with a pyroelectrical (solid-state) detector. The detector records the incoming infrared radiation. This radiation is reduced by the absorption of the gas at the corresponding wavelengths. By comparing the measurement and reference wavelength, an alternating voltage signal is produced. This signal results from the cooling and heating of the pyroelectric detector material.

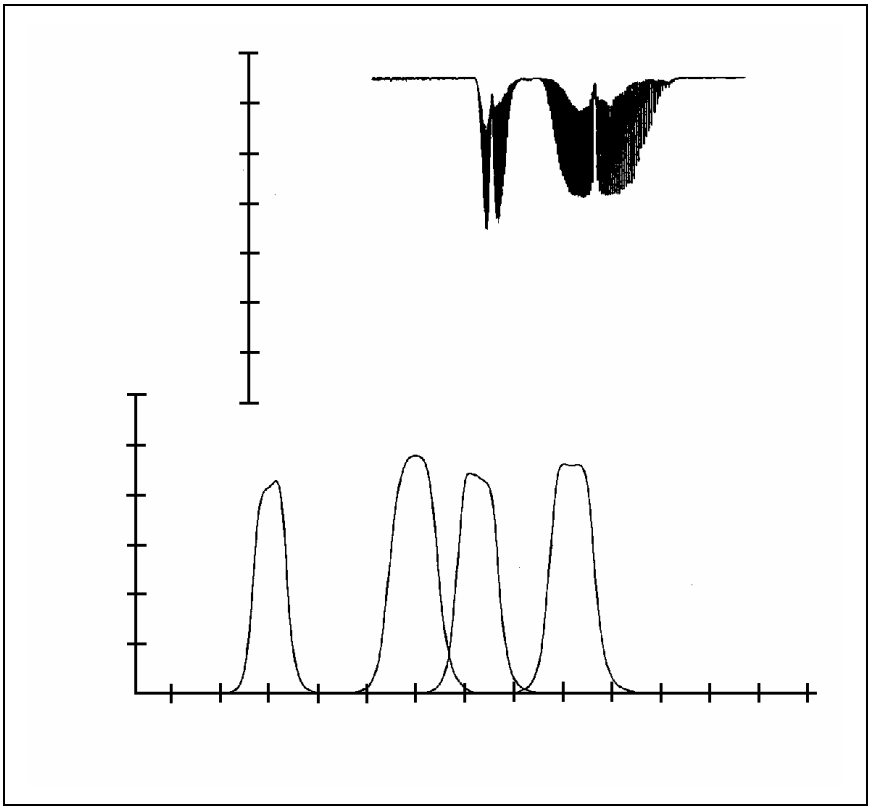


Figure 2-1. Absorption Bands of Sample Gas and Transmittance of Interference Filters

2.1.2 Opto-Pneumatic Method

In the opto-pneumatic method, a thermal radiator generates the infrared radiation which passes through the chopper wheel. This radiation alternately passes through the filter cell and reaches the measuring and reference side of the analysis cell with equal intensity. After passing another filter cell, the radiation reaches the pneumatic detector.

The pneumatic detector compares and evaluates the radiation from the measuring and reference sides of the analysis cell and converts them into voltage signals proportional to their respective intensity.

The pneumatic detector consists of a gas-filled absorption chamber and a compensation chamber which are connected by a flow channel in which a Microflow filament sensor is mounted. This is shown in Figure 2-2 below.

In principle the detector is filled with the infrared active gas to be measured and is only sensitive to this distinct gas with its characteristic absorption spectrum. The absorption chamber is sealed with a window which is transparent for infrared radiation. The window is usually Calcium Fluoride (CaF_2).

When the infrared radiation passes through the reference side of the analysis cell into the detector, no pre-absorption occurs. Thus, the gas inside the absorption chamber is heated, expands and some of it passes through the flow channel into the compensation chamber.

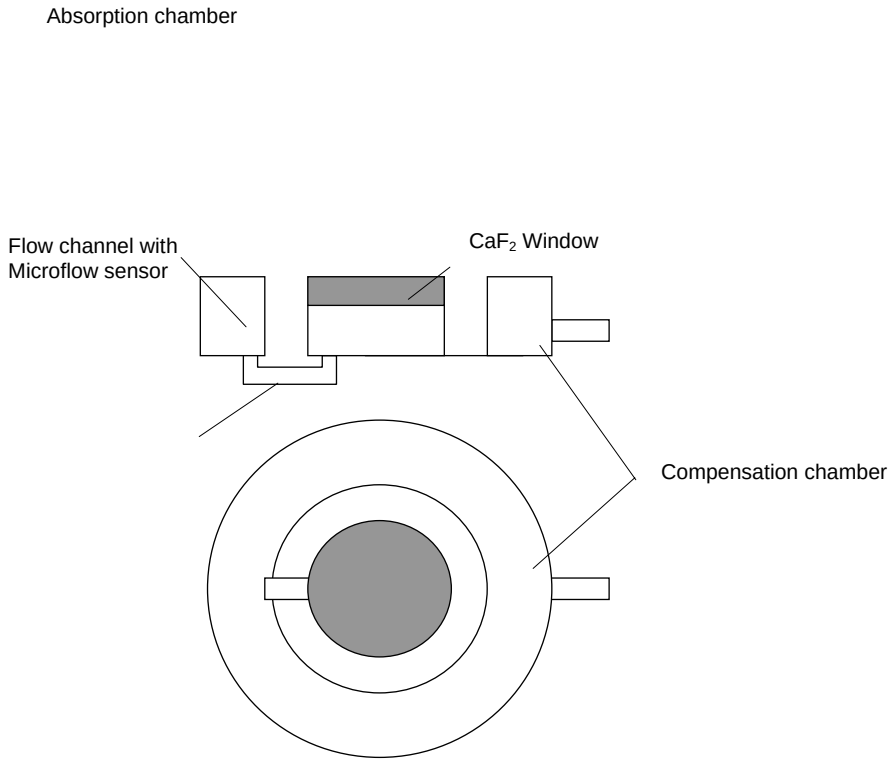


Figure 2-2. Opto-Pneumatic Gas Detector

When the infrared radiation passes through the open measurement side of the analysis cell into the detector, a part of it is absorbed depending on the gas concentration. The gas in the absorption chamber is, therefore, heated less than in the case of radiation coming from the reference side. Absorption chamber gas becomes cooler, gas pressure in the absorption chamber is reduced and some gas from the compensation chamber passes through the flow channel into the absorption chamber.

The flow channel geometry is designed in such a way that it hardly impedes the gas flow by restriction. Due to the radiation of the chopper wheel, the different radiation intensities lead to periodically repeated flow pulses within the detector.

The Microflow sensor evaluates these flow pulses and converts them into electrical pulses which are processed into the corresponding analyzer output.

2.1.3 Overall NDIR Method

In the case of dual-channel analyzers, the broadband emission from two infrared sources pass through the chopper wheel. In the case of the Interference Filter Correlation (IFC) method, the infrared radiation then passes through combinations of interference filters. In the case of the opto-pneumatic method, the infrared radiation passes through an optical filter depending on the application and need for reduction of influences. Then the infrared radiation enters the analysis cells from which it is focused by filter cells onto the corresponding detector. The preamplifier detector output signal is then converted into the analytical results expressed directly in the appropriate physical concentration units such as percent volume, ppm, mg/Nm^3, etc. This is shown in Figure 2-3 below.

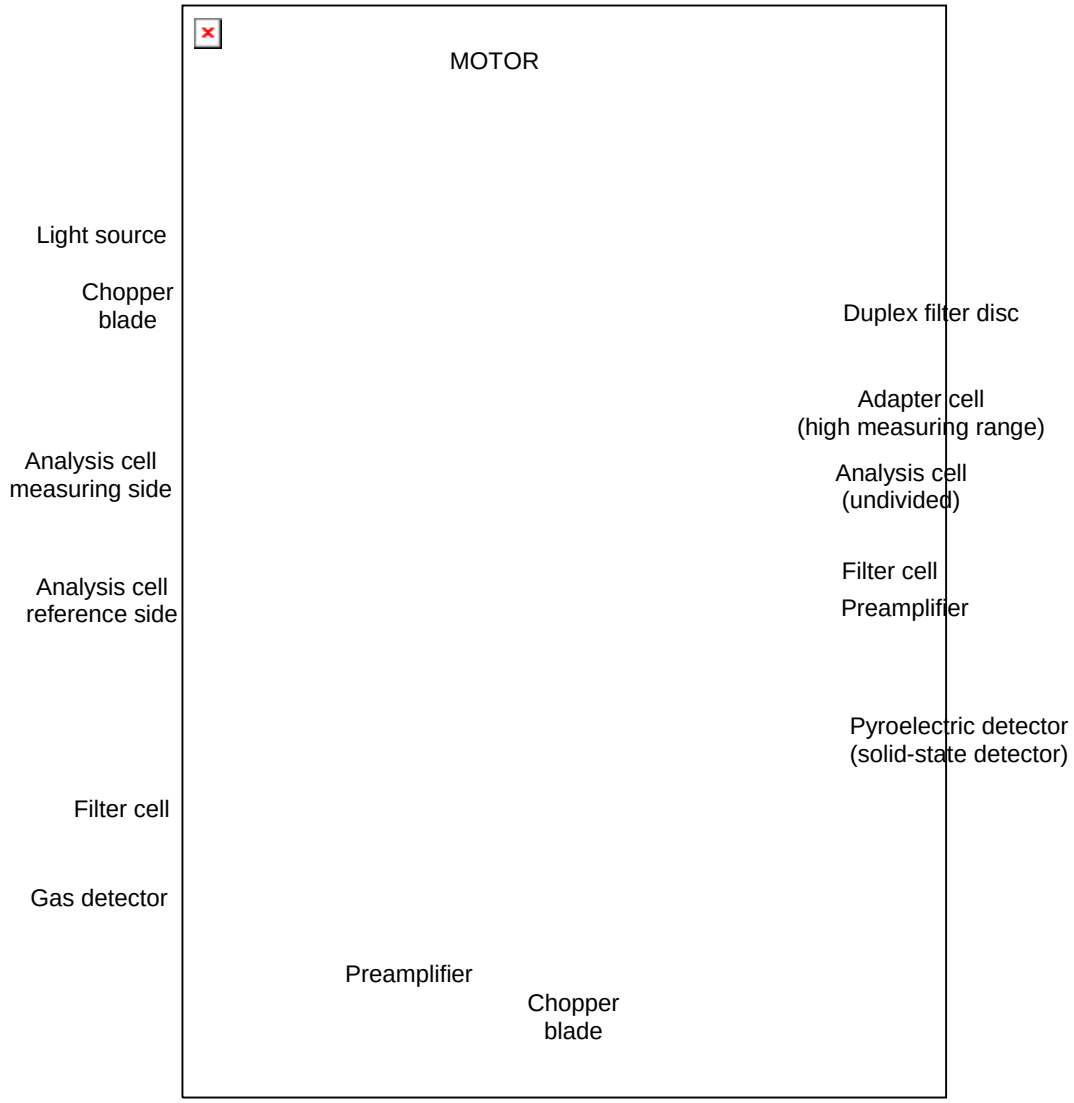


Figure 2-3. Overall NDIR Method

2.2 Paramagnetic Oxygen Method

The paramagnetic principle refers to the induction of a weak magnetic field, parallel and proportional to the intensity of a stronger magnetizing field.

The paramagnetic method of determination of oxygen concentration utilizes nitrogen filled quartz spheres arranged at opposite ends of a bar, the center of which is suspended by and free to rotate on a thin platinum wire ribbon in a cell. Nitrogen (N2) is used because it is diamagnetic or repelled by a magnet.

A small mirror that reflects a light beam coming from a light source to a photodetector, is mounted on the platinum ribbon. A strong permanent magnet specifically shaped to produce a strong, highly inhomogeneous magnetic field inside the analysis cell, is mounted outside the wall of the cell.

When oxygen molecules enter the cell, their paramagnetism will cause them to be drawn towards the region of greatest magnetic field strength. The oxygen molecules thus exert different forces on the two suspended nitrogen filled quartz spheres, producing a torque which causes the mirror to rotate away from its equilibrium position.

The rotated mirror deflects the incident light onto the photodetector creating an electrical signal which is amplified and fed back to a coil attached to the bar holding the quartz spheres, forcing the suspended spheres back to the equilibrium position.

The current required to generate the restoring torque to return the quartz bar to its equilibrium position is a direct measure of the O_2 concentration in the sample gas.

The complete paramagnetic analysis cell consists of an analysis chamber, permanent magnet, processing electronics, and a temperature sensor. The temperature sensor is used to control a heat exchanger to warm the measuring gas to about 55 °C.

2.3 Electrochemical Oxygen Method

The electrochemical method of determining oxygen concentration is based on the galvanic cell principle shown in Figure 2-4 below.

Figure 2-4. Electrochemical Oxygen Sensor

The electrochemical oxygen sensor incorporates a lead and gold galvanic process with a lead anode (1) and a gold cathode (2), using an acid electrolyte (3).

Oxygen molecules diffuse through a non-porous Teflon membrane (4) into the electrochemical cell and are reduced at the gold cathode. Water is the byproduct of this reaction.

On the anode, lead oxide is formed which is transferred into the electrolyte. The lead anode is continuously regenerated and, therefore, the electrode potential remains unchanged for a long time. The rate of diffusion and corresponding response time (t_{90}) of the sensor is dependent on the thickness of the Teflon membrane.

The electric current between the electrodes is proportional to the O_2 concentration in the sample gas being measured. The resultant signal is measured as a voltage across the resistor (6) and thermistor (5), the latter of which is used for temperature compensation. A change in the output voltage (mV) represents oxygen concentration.

NOTE: The electrochemical O_2 cell requires a minimum internal consumption of oxygen. Sample gases with an oxygen concentration of less than 2% could result in a reversible detuning of sensitivity and the output will become unstable. The recommended practice is to purge the cell with conditioned ambient air between periods of measurement. If the oxygen concentration is below 2% for several hours or days, the cell must be regenerated for about one day with ambient air. Temporary flushing with nitrogen (N_2) for less than one hour (analyzer zeroing) will have no effect on the sensitivity or stability.

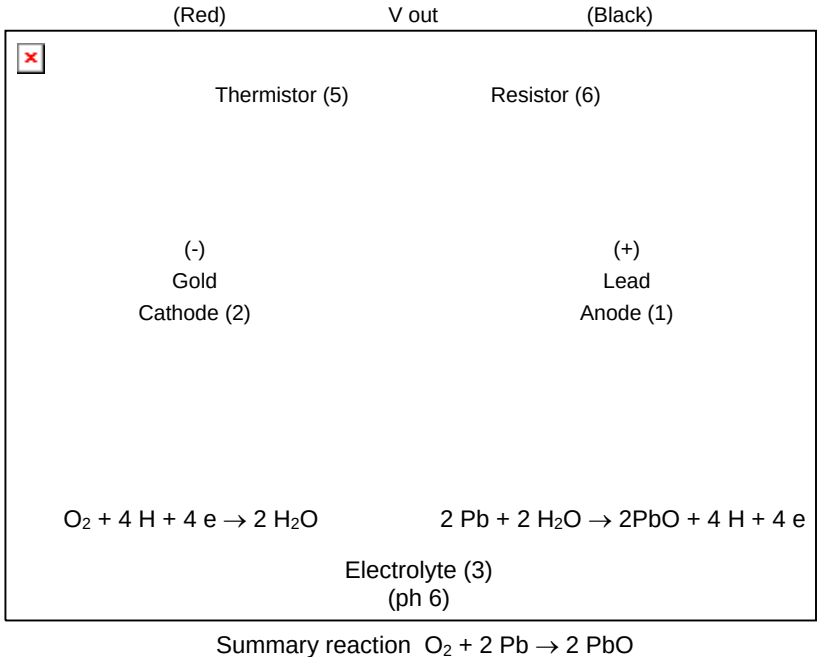


Figure 2-5 Reaction of Galvanic Cell

3. Installation

WARNING: ELECTRICAL SHOCK HAZARD

Installation and servicing of this device requires access to components which may present electrical shock and/or mechanical hazards. Refer installation and servicing to qualified service personnel.

CAUTION: CODE COMPLIANCE

Installation of this device must be made in accordance with all applicable national and/or local codes. See specific references on installation drawing located in the rear of this manual.

3.1 Specifications

Electrical Power
See Specifications in Preface

Power Cable

AC Operation: 16 gauge, minimum.

Gas Lines
For external gas lines, the use of all new tubing throughout is strongly recommended. The preferred type is new, Teflon or Stainless Steel tubing, sealed at the ends.

Services
AC as well as input and output digital and analog signals connect through the circular connectors located on the bottom of the uCEM enclosures.

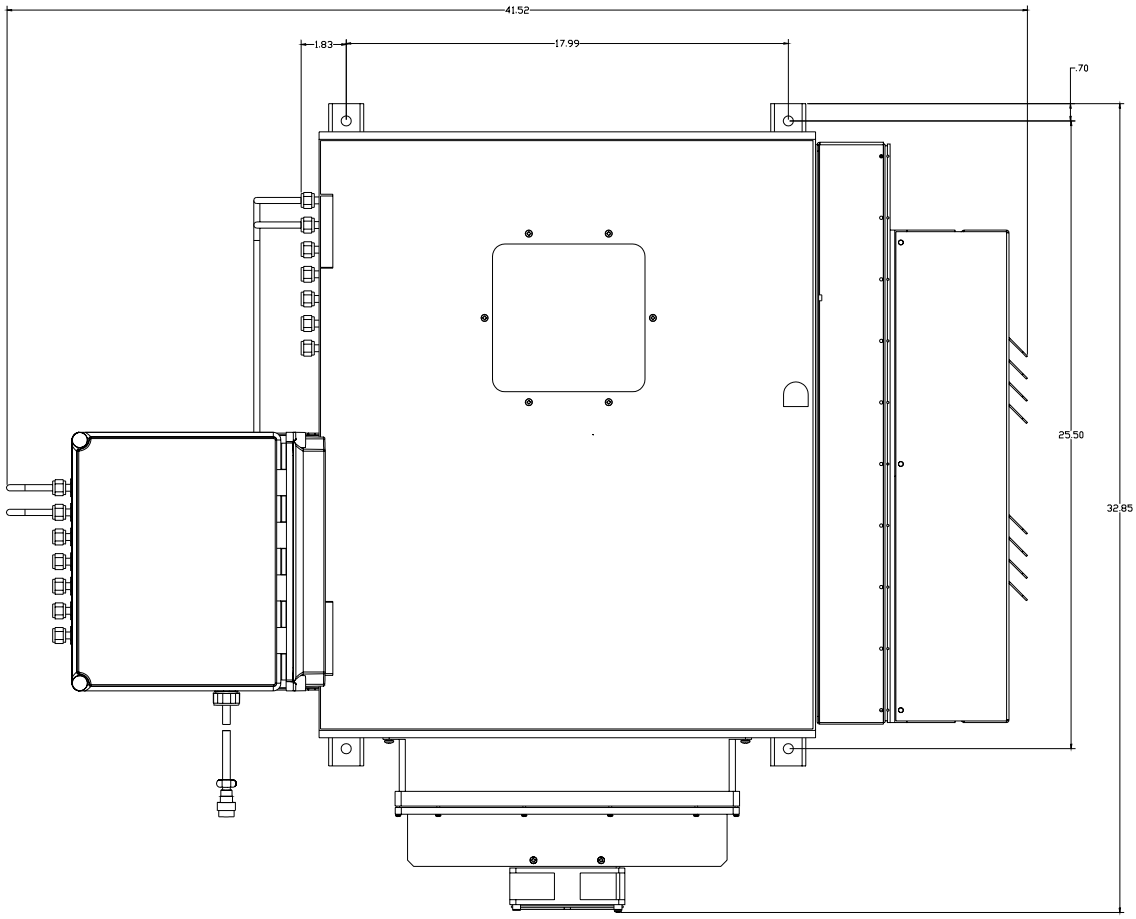
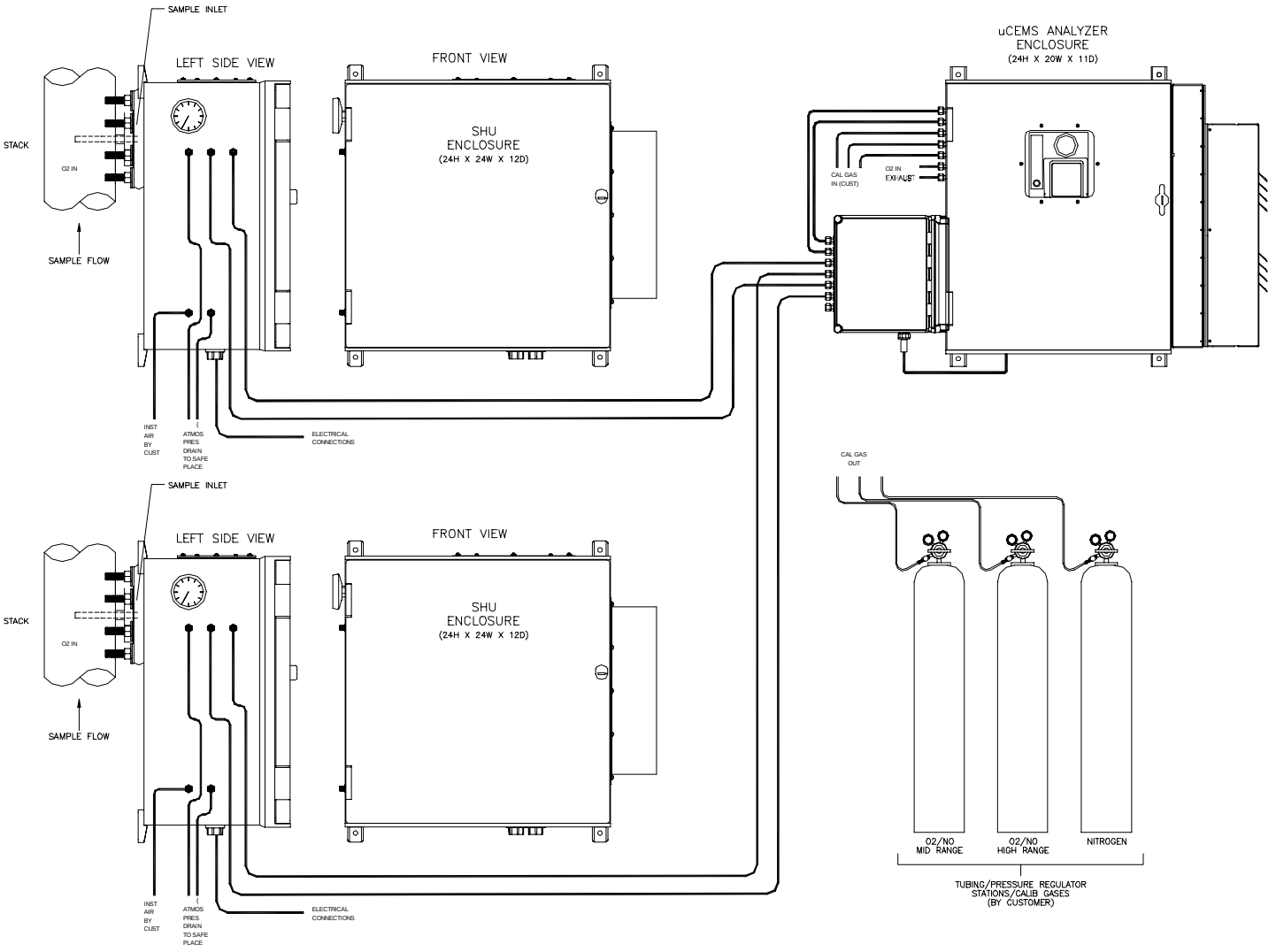


Figure 3-1. Dimensional Drawing, Door closed. Shown with Time Share option.


SAMPLE INLET
LEFT SIDE VIEW
FRONT VIEW
STACK
O2 IN
SAMPLE FLOW
SHU
ENCLOSURE
(24H X 24W X 12D)
uCEMS ANALYZER
ENCLOSURE
(24H X 20W X 11D)
CAL GAS
IN (CUST)
O2 IN
EXHAUST
INST
AIR
BY
CUST
ATMOS
PRES
DRAIN
TO SAFE
PLACE
ELECTRICAL
CONNECTIONS
CAL GAS
OUT
O2/NO
MID RANGE
O2/NO
HIGH RANGE
NITROGEN
TUBING/PRESSURE REGULATOR
STATIONS/CALIB GASES
(BY CUSTOMER)

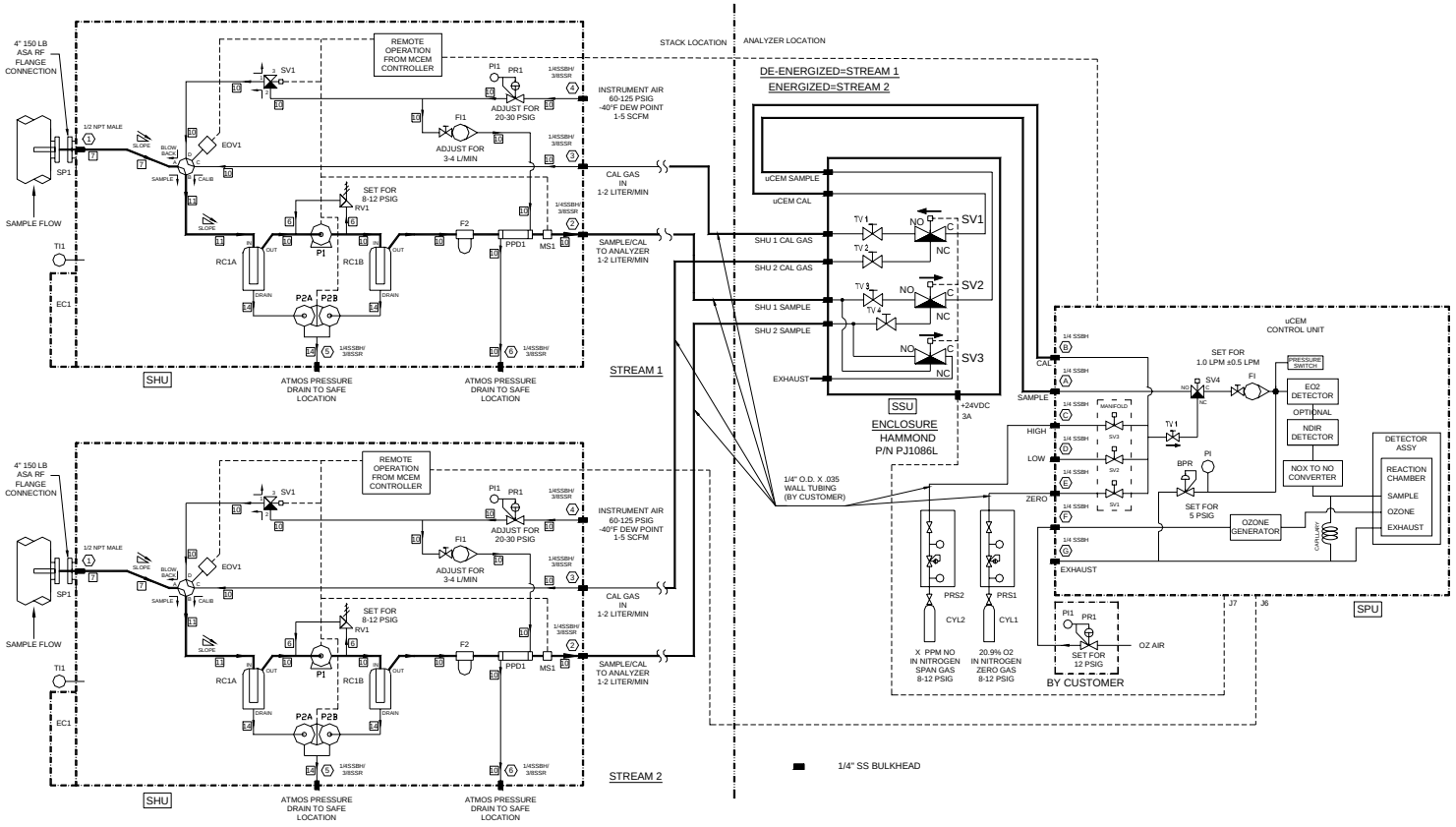


Figure System Flow Diagram

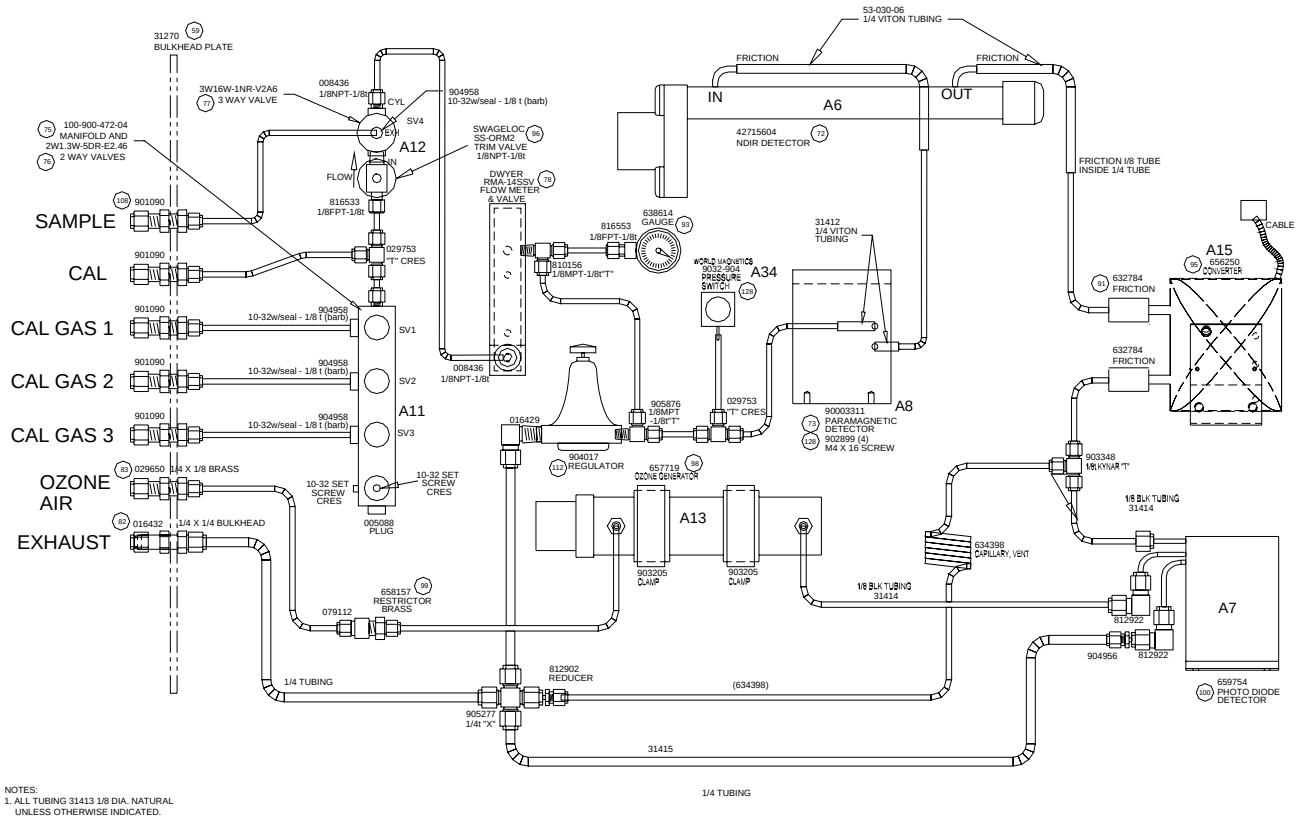


Figure 3-3 Analysis Enclosure Internal Gas flow diagram

Analysis Enclosure Critical settings and control:

1. **Set MicroCEM Pressure guage (P1)to 5 psig +/- 0.5psig. Pressure set by BPR located behind gauge in detector section. If CO and NOx response times are sluggish this pressure can be increased.**
2. **Set Calibration gas cylinder dual stage pressure regulators to 10 to 20 psig.**
3. **Set Flowmeter (F1) to 500cc to 1500cc per min.**
4. **TV1 is used to balance the flow between a probe and local calibration. It is located beside the solenoid valve manifold.**
5. **Set Ozone air pressure to 12 psig.**
6. **Exhaust line should be free of any backpressure. Immediately vent into ½" pipe.**
7. **Time Share Box:**
   - **TV1: Use to equalize cal gas flow between SHU1 and SHU2.**
   - **TV2: Use to equalize cal gas flow between SHU1 and SHU2.**
   - **TV3: Use to equalize sample flow between SHU1 and SHU2.**
   - **TV4: Use to equalize sample flow between SHU1 and SHU2.**
8. **Pressure Switch: The pressure switch is located beside the pressure gauge. If the sample or cal gas pressure flow below 2.5 psig the MicroCEM will give trouble alarm. The alarm will turn off upon pressure above 4 psig.**

3.2 Process and Calibration Gas Connection

Besides sample gas, the µCEM requires other gases for operation. In most cases, one or more Calibration Standards must be provided. These should be cylinders of gas which closely resemble the expected sample, both in species and concentrations. These calibration gases are normally introduced into the system as an input to the Sample Conditioning Plate Option or sample conditioning may be provided by others.

Each gas cylinder should be equipped with a clean, hydrocarbon free two-stage regulator with indicating gauges of approximately 0 to 3000 psig (0 to 20.7 Mpa) for cylinder pressure and 0 to 100 psig (0 to 689 Kpa) for delivery pressure. Regulators should have a metallic as opposed to elastomeric diaphragm, and provide for ¼ inch compression fitting outlet and should be LOX clean.

NOTE: All connections specified in the Installation Drawing, in conjunction with the Application Data Sheet, should be made.

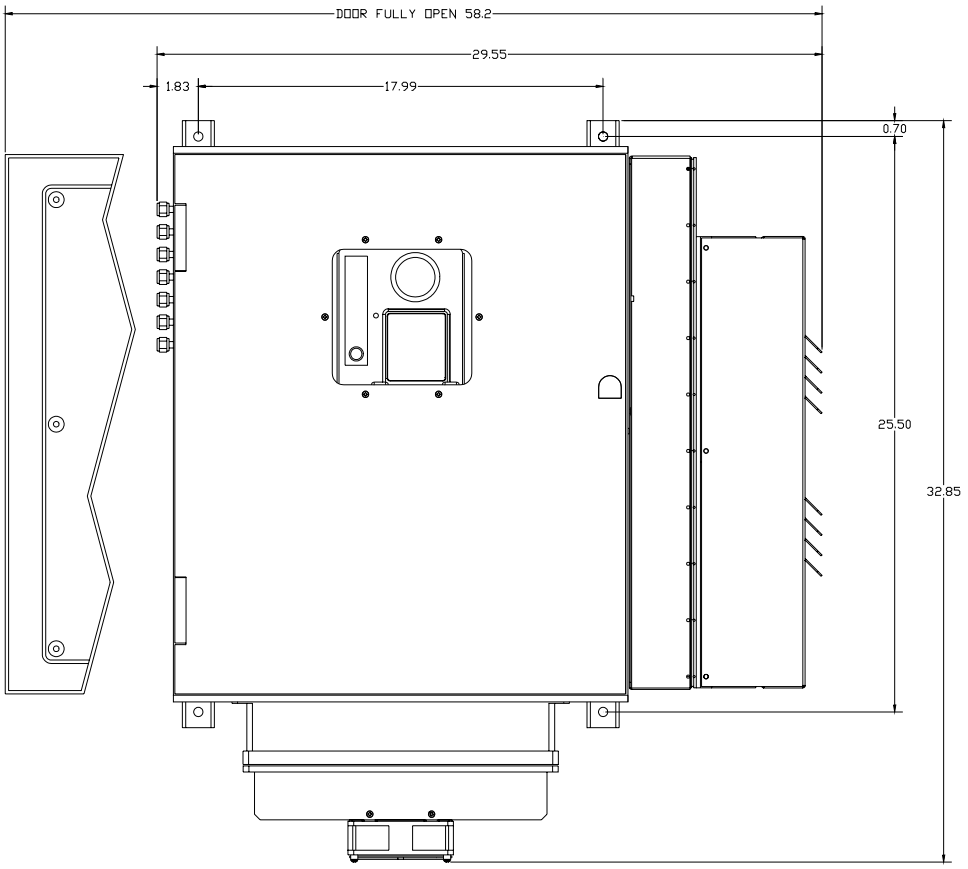


Figure 3-5. Gas Connections

1 – Sample Gas Inlet (From Probe)	2 – Calibration Gas (From Probe)	3 – Gas 3 Inlet (Cal Gas)	4 – Gas 2 Inlet (Cal Gas)
5 – Gas 1 Inlet (Cal Gas)	6 – Ozone/Air Inlet (By Cust)	7 – Vent (To Cust vent)	

3.2.1 Gas Conditioning

All gases must be supplied to the analyzer as conditioned gases! When the system is used with corrosive gases, it must be verified that there are no gas components which may damage the gas path components.

The gas conditioning must meet the following conditions:

Free of condensable constituents

Free of dust above 2 μm

Free of aggressive constituents which may damage the gas paths

Temperature and pressure in accordance with the specifications

When analyzing vapors, the dewpoint of the sample gas must be at least 10 °C below the ambient temperature in order to avoid the precipitation of condensate in the gas paths.

An optional barometric pressure compensation feature can be supplied for the μCEM. This requires a pressure sensor with a range of 800 – 1,100 hPa. The concentration

values computer by the detectors will then be corrected to eliminate erroneous measurements due to changes in barometric pressure.

The gas flow rate must be in the range of 0.5 l/min to a maximum of 1.5 l/min. A constant flow rate of 1 l/min is recommended. NOTE: The maximum gas flow rate for paramagnetic oxygen detectors is 1.0 l/min!

3.3 Installation

WARNING: ELECTRICAL SHOCK HAZARD

Care should be taken if hazardous gases are to be measured or used for calibration.

Refer to installation drawing supplied with the application data package.

3.3.1 Location

The µCEM is designed to be installed in an outdoor environmental location. It is highly recommended that the analyzer be located out of direct sunlight and direct rain/snow to the extent possible to assure longevity and accuracies.

The µCEM analysis enclosure should be installed as near as possible to the probe/sample handling enclosure, in order to avoid low response time caused by long sample gas lines.

The enclosure must be grounded to earth by the user or ground loops and computer lockups are possible.

3.3.2 Limitations

Ambient Temperature: -30° to 50° Celsius (-34° to 122° F)

Relative Humidity: 5% to 99%

3.3.3 Mounting Options

Although the µCEM is enclosed in an environmentally sealed enclosure, it should be protected from direct sunlight. In areas subjected to harsh winter climates, protection should be provided from sun, rain and snow. A corrigated awning or other suitable means can be provided to meet these conditions.

3.3.4 Electrical Connections

NOTE: The enclosure is a NEMA 4x. All entry locations must be sealed.

Connect all required signal cables to the connections at the bottom of the µCEM. The cable locations are indicated on the inside bottom cover of the µCEM box. The actual electrical connections will be specified in the Application Data package. All connections are not necessary for every application.

Cable length for these signals should not exceed 3,000 feet (914 meters), to avoid excessive capacitance and corresponding signal distortion.

All connections are made through the bottom of the µCEM enclosure using circular connectors. Mating circular external connectors are provided by Rosemount with a 6’ wire harness pigtail for connections to J1, J3, J5, J6, J7 & J8.

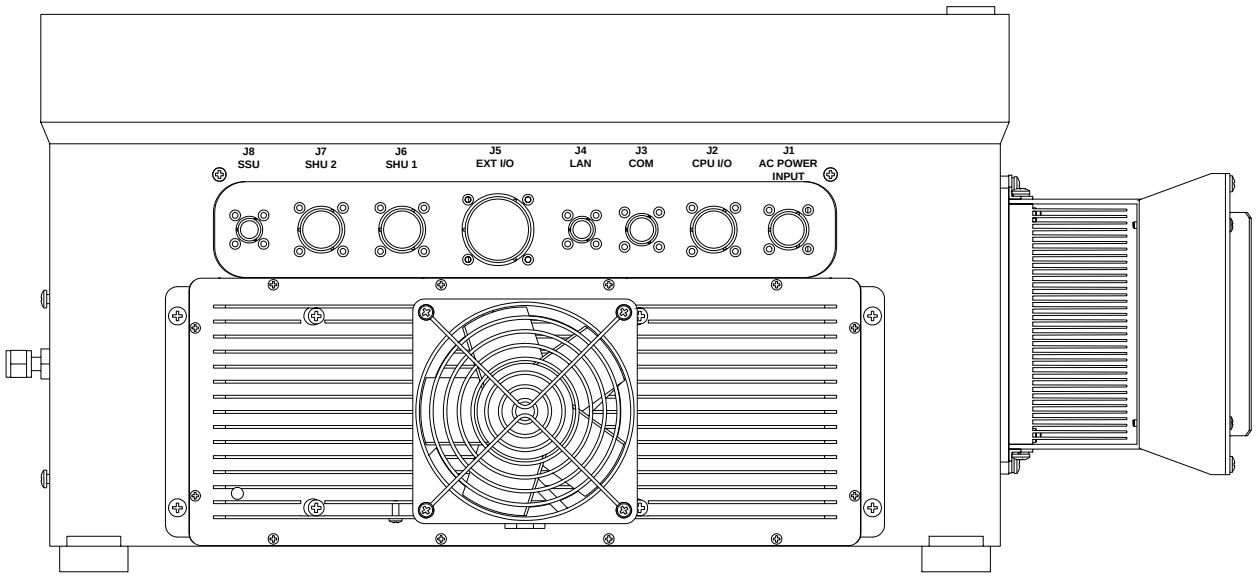


Figure 3-6 Electrical Connections

J1 – AC Power Input

J2 – CPU I/O

J3 – COM Interface (pocket pc)

J4 – Ethernet LAN Port

J5 – EXT I/O Interface

J6 – SHU #1 Interface

J7 – SHU #2 Interface (T/S units only)

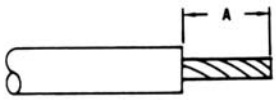
J8 – SSU Power (T/S units only)

3.3.4.1 Circular Connector Assembly Instructions

Refer to Figure 3-7 for instructions.

Wire Stripping

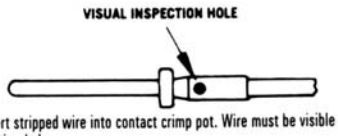
Strip insulation from end of wire to be crimped. (See table for proper stripping dimensions.) Do not cut or damage wire strands.



Wire Size	A
22D or 22M*	.125 (3.18)
20	.188 (4.77)
16	.188 (4.77)
12	.188 (4.77)

* Inactive, not recommended for new design, replacement only.

Contact Crimping



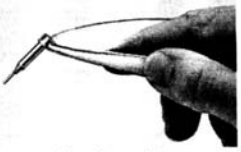
1. Insert stripped wire into contact crimp pot. Wire must be visible thru inspection hole.

2. Using correct crimp tool and locator, cycle the tool once to be sure the indentors are open. Insert contact and wire into locator. Squeeze tool handles firmly and completely to insure a proper crimp. The tool will not release unless the crimp indentors in the tool head have been fully actuated.

3. Release crimped contact and wire from tool. Be certain the wire is visible thru inspection hole in contact.

Contact Insertion

1. Remove hardware from plug or receptacle and slip over wire bundle in proper order for reassembly.



2. Using proper plastic or metal insertion tool for corresponding contact, position wire in tip of the tool so that the tool tip butts up against the contact shoulder.

3. Press tool against contact shoulder and, with firm and even pressure, insert wired contact and tool tip into center contact cavity. A slight click may be heard as metal retaining tines snap into place behind contact shoulder.

4. Remove tool and pull back lightly on wire to make sure contact is properly seated. Repeat operation with remainder of contacts to be inserted, beginning with the center cavity and working outward in alternating rows.

5. After all contacts are inserted, fill any empty cavities with wire sealing plugs. Reassemble plug or receptacle hardware.

Contact Extraction

1. Remove hardware from plug or receptacle and slide hardware back along wire bundle.

2. Using plastic or metal extraction tool with proper color code corresponding to contact size, place wire in tool.

3. Insert tool into contact cavity until tool tip bottoms against the contact shoulder, expanding clip retaining tines.

4. Hold wire firmly in tool and extract wired contact and tool. Repeat operation for all contacts to be extracted.

5. Fill any empty wire cavities with wire sealing plugs, and

6. Reassemble plug or receptacle.

Figure 3-7. Circular Connector Assembly Instructions

3.3.4.2 EXT I/O Interface Connector (J5) - MicroCEM inputs and outputs are specific for customer use.

The Analog Interface connector has a shell size of 22, 100 contacts. Each pin will accept a wire size of 26, 24, or 22 AWG. Connector and 6' pigtail by Rosemount.

Pin#	NAME	DESCRIPTION	COLOR	AWG	NOTES
1	O2CL+	O2 Stream#1 Reading, 4-20 mA Output	WHT	22	Analog Output / Twisted Pair wire
2	O2CL-		BLK	22	
3	COCL+	CO Stream#1 Reading, 4-20 mA Output	WHT	22	Analog Output / Twisted Pair wire
4	COCL-		BRN	22	
5	NOxCL+	NOx Stream#1 Reading, 4-20 mA Output	WHT	22	Analog Output / Twisted Pair wire
6	NOxCL-		RED	22	
7	EXP1CL+	External process (No. 1), Customer Analog input, 4-20 mA	WHT	22	Analog Input / Twisted Pair wire
8	EXP1CL-		ORG	22	
9	EXP2CL+	External process (No. 2), Customer analog input, 4-20 mA	WHT	22	Analog Input / Twisted Pair wire
10	EXP2CL-		YEL	22	
11	FLAME1	Flame Detect OR Initiate calibration, Stream#1, Optically Isolated Input (Dry contact by customer)	WHT	22	Digital Input / Twisted Pair wire (Cust
12	FLAME1RTN		GRN	22	
13	PROCON1	Process On, Stream#1, Optically Isolated Input (Dry contact by customer)	WHT	22	Digital Input / Twisted Pair wire
14	PROCON1RTN		BLU	22	
15	O2CL2+	O2 Stream#2 Reading, 4-20 mA Output	WHT	22	Analog Output / Twisted Pair wire
16	O2CL2-		VIO	22	
17		CO Stream#2 Reading, 4-20 mA Output	WHT	22	Analog Output / Twisted Pair wire
18	COCL2-		GRY	22	
19	NOxCL2+	NOx Stream#2 Reading, 4-20 mA Output	BLK	22	Analog Output / Twisted Pair wire
20	NOxCL2-		BRN	22	
21	EXP3CL+	External process (No. 3), Current Loop input, 4-20 mA	BLK	22	Analog Input / Twisted Pair wire
22	EXP3CL-		RED	22	
23	EXP4CL+	External process (No. 4), Current Loop input, 4-20 mA	BLK	22	Analog Input / Twisted Pair wire
24	EXP4CL-		ORG	22	
25	FLAME2	Flame Detect, Stream#2, Optically Isolated Input (Wet contact)	BLK	22	Digital Input / Twisted Pair wire
26	FLAME2RTN		YEL	22	
27	PROCON2	Process On, Stream#2, Optically Isolated Input (Wet contact)	BLK	22	Digital Input / Twisted Pair wire
28	PROCON2RTN		GRN	22	
29	TRBLNO	Trouble Indicator, Dry contact, 110V 1A Rating	BLK	22	Digital Output / Twisted Pair wire
30	TRBLC		BLU	22	
31	TRBLNC		BLK	22	

94	Spare		VIO	22	
32	Shutdown1+	ShutDown, Stream#1 Mode (Wet contact)	BLK	22	Digital Input / Twisted Pair wire
33	Shutdown1-		GRY	22	
34	O2LR+	O2 Range indicator (0V =range 1, 5V = range 2)	BRN	22	Digital Output TTL / Twisted Pair wire
35	O2LR-		RED	22	
36	COLR+	CO Range indicator (0V =range 1, 5V = range 2)	BRN	22	Digital Output TTL / Twisted Pair wire
37	COLR-		ORG	22	
38	NOxLR+	NOx Range indicator (0V =range 1, 5V = range 2)	BRN	22	Digital Output TTL / Twisted Pair wire
39	NOxLR-		YEL	22	
40	O2OL+	O2 Over Limit Indicator OR Valid (0V = normal, 5V = alarm)	BRN	22	Digital Output TTL / Twisted Pair wire
41	O2OL-		GRN	22	
42	COOL+	CO Over Limit Indicator OR In Calibration (0V = normal, 5V = alarm)	BRN	22	Digital Output TTL / Twisted Pair wire
43	COOL-		BLU	22	
44	NOxOL+	NOx Over Limit Indicator OR In Maintenance (0V = normal, 5V = alarm)	BRN	22	Digital Output TTL / Twisted Pair wire
45	NOxOL-		VIO	22	
46	STNNO	Stream Number Indicator, Optically Isolated Output, Drty contact (open = Stream#1 / closed = Stream#2)	BRN	22	Digital Output / Twisted Pair wire
47	STNC		GRY	22	
74	BAROP+		RED	22	Not Used
75	BAROP-		YEL	22	
98	Spare		RED	22	Spare
100	Spare		ORG	22	
72	Shutdown2+	ShutDown, Stream#2 Mode (Wet contact)	RED	22	Digital Input / Twisted Pair wire
73	Shutdown2-		GRN	22	

Table 3-1. EXT I/O Terminal Assignments

3.3.4.3 SHU #1 / #2 Interface Connector (J6 & J7). These wires are to be connected directly to the MicroCEM sample handling enclosure (SHU) and will control the operation of the sample pump, drain pump, purge valve and calibration valve respetively. All toggle switches in sample handling enclosure should be set to “remote” mode upon hookup of wire so the MicroCEM analysis enclosure will control the full system.

The Digital Interface connector has a shell size of 14, 15 contacts. Each pin will accept a wire size of 20 AWG. Connector and 6’ pigtail by Rosemount.

PIN	NAME	DESCRIPTION	COLOR	Sample Handling Enc. Termination
1	SPUMP1/2NO	Sample Pump #1/2 Control, Dry contact, 110V 1A	BLK	Not Used
2	SPUMP1/2C		BRN	1
3	SPUMP1/2NC		RED	8
4	DPUMP1/2NO	Drain Pump #1/2 Control, Dry contact, 110V 1A	ORG	Not Used
5	DPUMP1/2C		YEL	1
6	DPUMP1/2NC		GRN	3
7	PURG1/2NO	Purge Valve #1/2 Control, Dry contact, 110V 1A	BLU	4
8	PURG1/2C		VIO	1
9	PURG1/2NC		GRY	Not Used
10	CAL1/2NO	Calibration Valve #1/2 Control, Dry contact, 110V 1A	WHT	5
11	CAL1/2C		WHT/BLK	1
12	CAL1/2NC		WHT/BRN	Not Used

Internal Jumper terminals 2 and 9 set by Rosemount

Table 3-2. Sample Handling Unit Terminal Assignments

3.3.4.4 COM Interface Connector (J3) – Pocket PC external connection

The COM Interface connector has a shell size of 10, 13 contacts. Each pin will accept a wire size of 28, 26, or 24 AWG. Connector and 3' pigtail by Rosemount.

SIGNAL NAME	DEFINITION	PIN
DCD (pin 1)	Data Carrier Detect Input, RS232	1
DSR (pin 6)	Data Set Ready Input, RS232	2
RxD (pin 2)	Receive Data Input, RS232	3
RTS (pin 7)	Request to Send Output, RS232	4
TxD (pin 3)	Transmit Data Output, RS232	5
CTS (pin 8)	Clear To Send Input, RS232	6
DTR (pin 4)	Data Terminal Ready Output, RS232	7
RI (pin 9)	Ring Indicator Input, RS232	8
GND (pin 5)	Signal Ground, RS232	9
TxD/RxD+ (pin 2)	RS-485 Bidirectional Data	10
TxD/RxD- (pin 7)	RS-485 Bidirectional Data	11
GND (pin 3)	Signal Ground	12
VCC	+5V DC	13

Table 3-3. COM Interface Terminal Assignments

3.3.4.5 Lan Interface Connector (J4) – Customer PC, network or laptop connection

The Lan Interface connector has a shell size of 8, 6 contacts. Each pin will accept a wire size of 28, 26, 24, or 22 AWG.

SIGNAL NAME	DEFINITION	PIN
TxD+ (pin 1)	Transmit Data	1
TxD- (pin 2)		2
RxD+ (pin 3)	Receive Data	3
RxD- (Pin 6)		4
	Not Used	5-6

Table 3-4. LAN Interface Terminal Assignments

3.3.4.6 CPU I/O Interface Connector (J2) – Rosemount Factory trained port for communication with CPU hard drive

The CPU I/O Interface connector has a shell size of 14, 19 contacts. Each pin will accept a wire size of 28, 26, or 24 AWG.

PIN	NAME	DESCRIPTION
A	RED	RED CENTER
B	GND	RED SHIELD
C	GREEN	GREEN CENTER
D	GND	GREEN SHIELD
E	BLUE	BLUE CENTER
F	GND	BLUE SHIELD
G	HSYNC	GREY CENTER
H	GND	GREY SHIELD

J	VSYNC	BLACK CENTER
K	GND	BLACK SHIELD
L	DATA	DCC DATA
M	CLK	DCC CLK
N	KBDATA	KEYBOARD DATA
P	KBCLK	KEYBOARD CLOCK
R	GND	GROUND
S	VCC	VCC, +5VDC
R	GND	GROUND
S	VCC	VCC, +5VDC
T	MSDATA	MOUSE DATA
U	MSCLK	MOUSE CLOCK

Table 3-5. CPU I/O Terminal Assignments

3.3.4.7 SSU Power Connector, T/S units Only (J8) – T/S enclosure can be located away from the Analysis enclosure. This cable serves as the connection and is by Rosemount.

The SSU Power connector has a shell size of 8, 3 contacts. Each pin will accept a wire size of 24, 22, or 20 AWG. Connector and 6' pigtail by Rosemount.

SIGNAL NAME	DEFINITION	PIN
SSUCtrl	SSU Control line	A
Vbb_rtn	+24V Return	B
Gnd	GND	C

Table 3-6. SSU Power Connection Terminal Assignments

3.3.4.8 AC Power Connector (J1) – Customer 120VAC Power Connection

The AC Power Interface connector has a shell size of 12, 3 contacts. Each pin will accept a wire size of 16 AWG. Connector and 6' pigtail by Rosemount.

SIGNAL NAME	DEFINITION	PIN
L1	85-264 VAC, 47-440 Hz	A
L2		C
GND	AC Ground	B

Table 3-7. AC Power Connection Terminal Assignments

Connect AC power through a 20A circuit breaker that is to be located close to the µCEM. The circuit breaker will provide over current protection as well as a means of disconnecting the power.

Maximum power requirements will be 1000 watts, with most applications requiring less than this amount

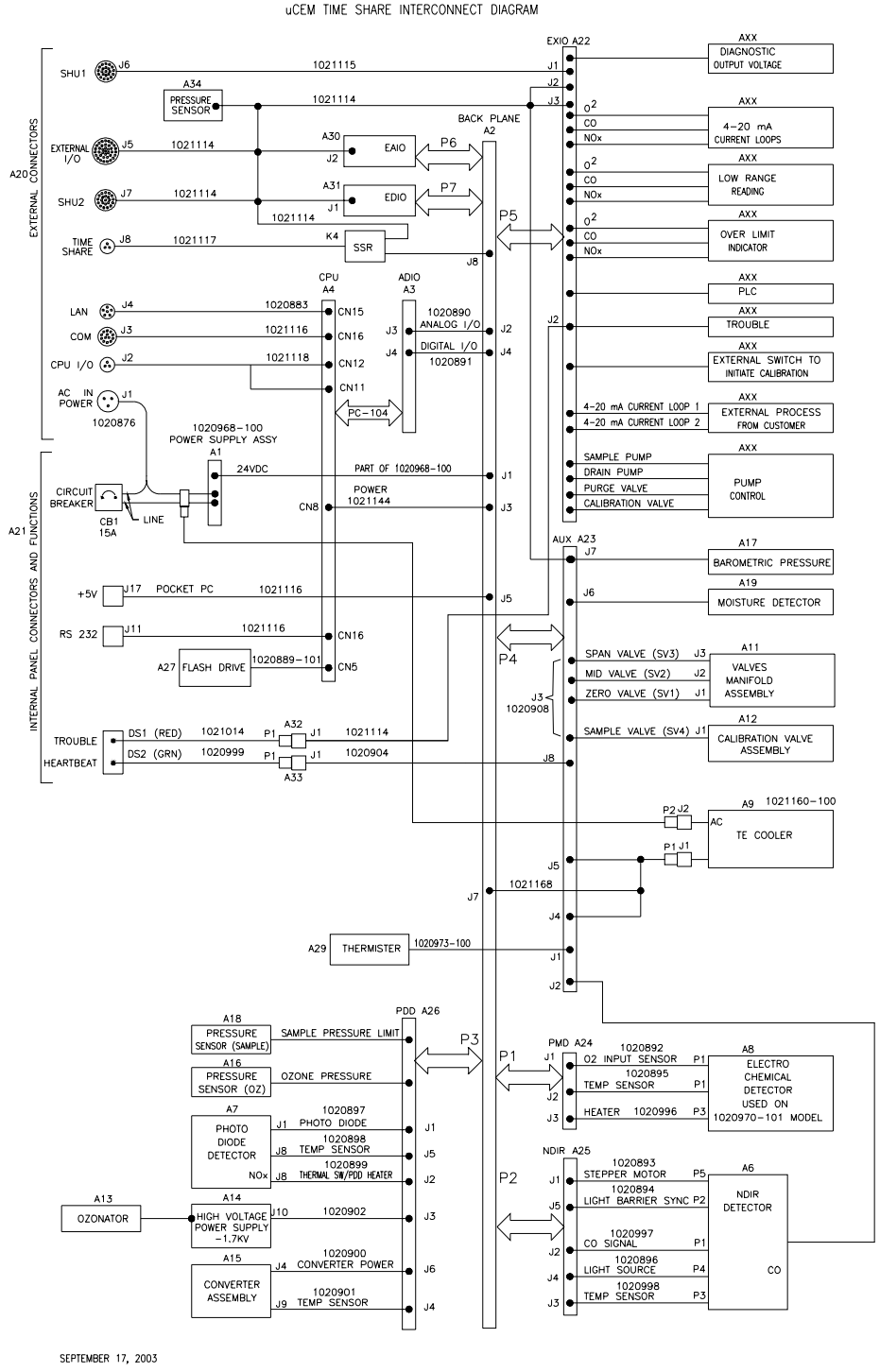


Figure 3-4. uCEM Analysis Enclosure interconnect diagram

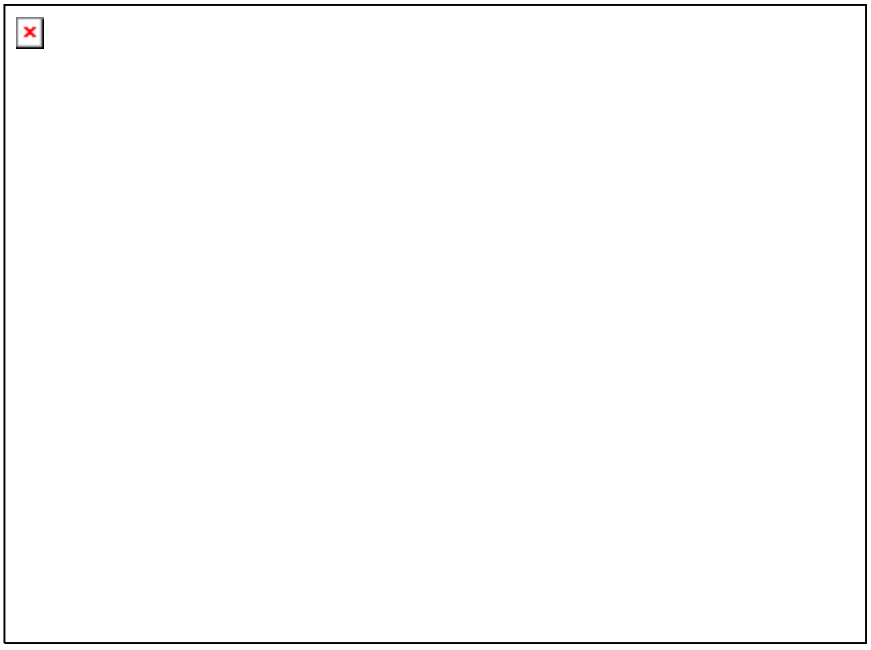
3.3.5 Analytical Leak Check

If explosive or hazardous gas samples are being measured with the µCEM, it is recommended that gas line fittings and components be thoroughly leak-checked prior to initial application of electrical power, and at bimonthly intervals thereafter, as well as after any maintenance which involves breaking the integrity of the sample containment system.

3.3.5.1 Flow Indicator Method

Figure 3-8. Leak Test Flow Method

Supply air or inert gas such as nitrogen, at 10 psig (689 hPa), to the analyzer through a flow indicator with a range of 0 to 250 cc/min. Install a shut-off valve at the sample gas outlet. Set the flow rate to 125 cc/min.



Close the outlet shut-off valve and notice that the flow reading drops to zero. If the flow reading does not drop to zero, the system is leaking and must be corrected before the introduction of any flammable sample gas or application of power.

3.3.5.2 Manometer Method

Install a water-filled U-tube manometer at the sample gas outlet. Install a shut-off valve at the sample gas inlet. Admit air or inert gas to the inlet shut-off valve until the analyzer is pressurized to approximately 50 hPa. The water column will be about 500 mm.

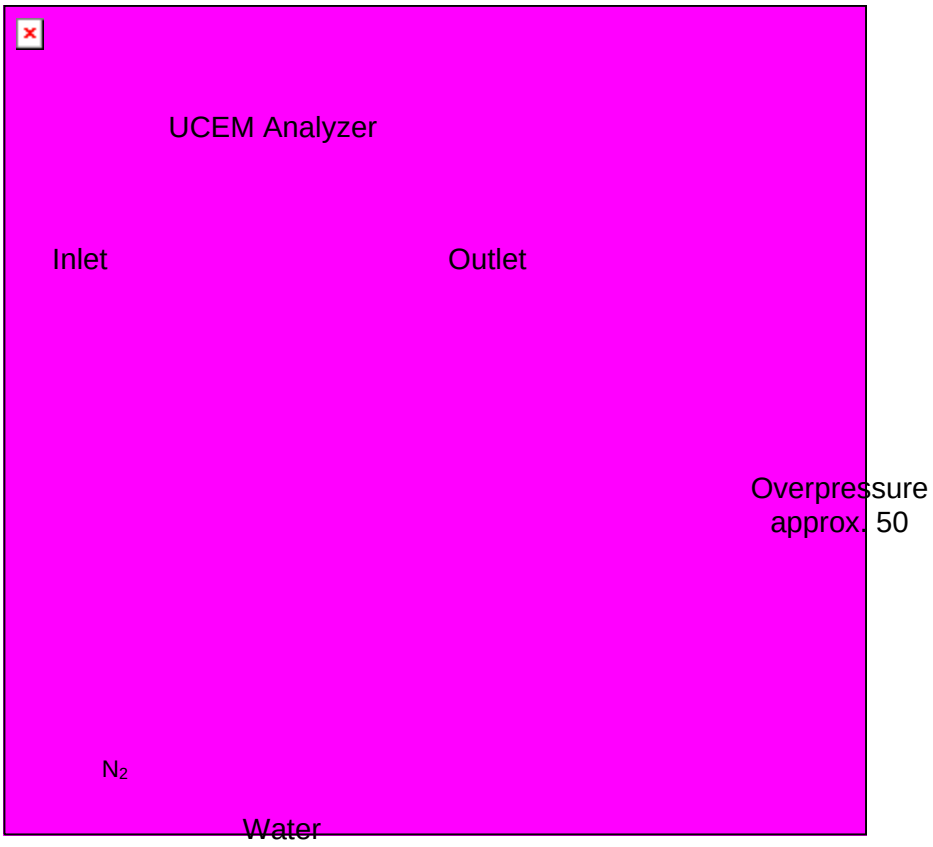


Figure 3-9. Leak Test Manometer Method

Close the inlet shut-off valve and, following a brief period for pressure equilibrium, verify that the height of the water column does not drop over a period of about 5 minutes. If the water column height drops, the system is leaking and must be corrected before the introduction of any flammable sample gas or application of power.

3.3.5.3 Troubleshooting Leaks

Liberally cover all fittings, seals, and other possible sources of leakage with a suitable leak test liquid such as SNOOP™ (part 837801). Bubbling or foaming indicates leakage. Checking for bubbles will locate most leaks but could miss some, as some areas are inaccessible to the application of SNOOP. For positive assurance that system is leak free, perform one of the preceding tests.

NOTE:

Refer to Specification in Preface for maximum pressure limitations.

For differential measurement, the leak check must be performed for the measurement and reference side separately.

For analyzers with parallel gas paths, the leak check must be performed for each gas path separately.

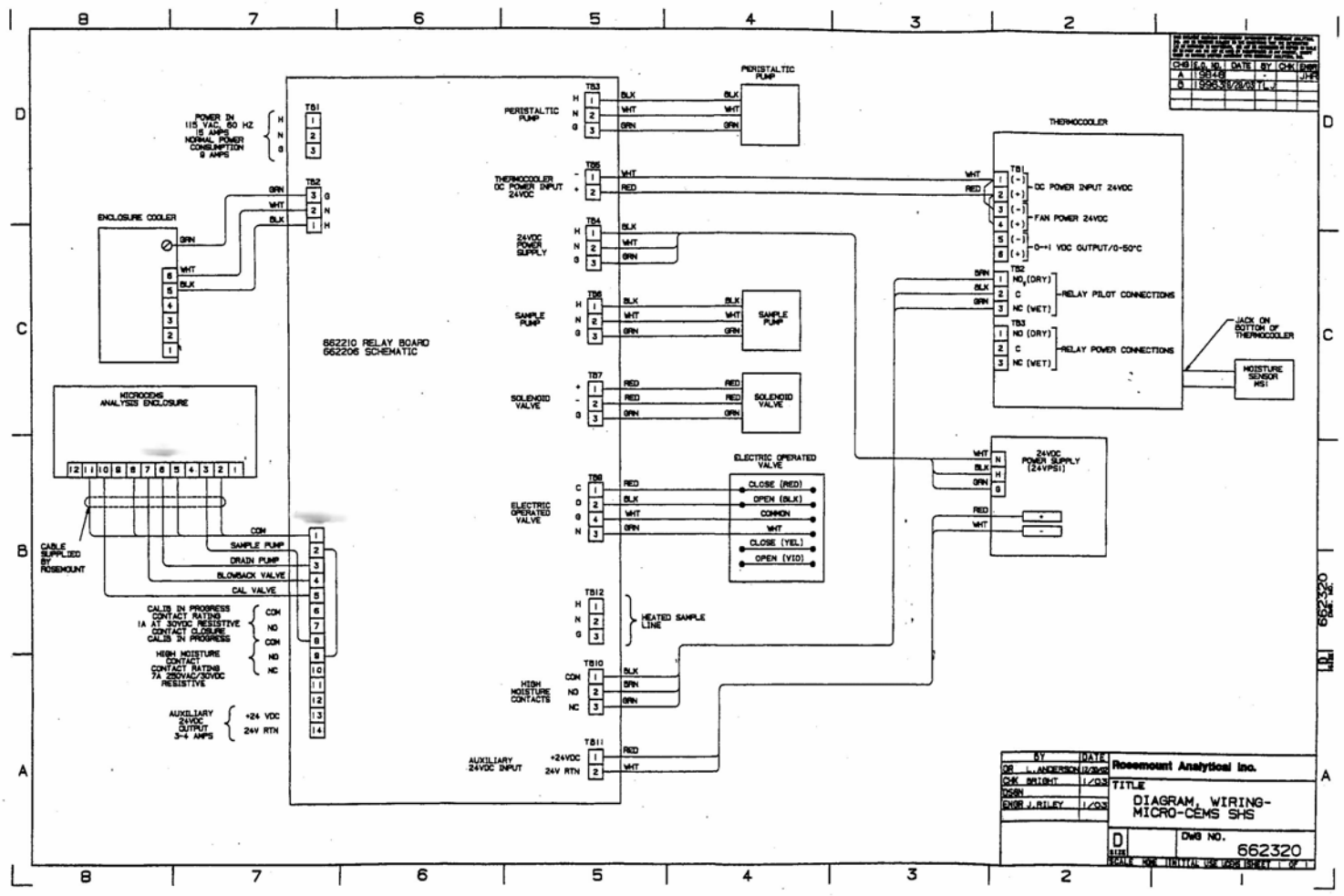


Figure illustrates MicroCEM analysis enclosure (Left) wire connections to the Sample Handling box

™ Trademark of NUPRO Company

4. Startup and Operation

4.1 Startup Procedure

Once the µCEM has been correctly assembled and installed in accordance with the instructions in Section 1.1, “

Installation," the analyzer is ready for operation.

Before operating the system, verify that the Leak Checks have been performed and that the sample handling unit is performing correctly.

MicroCEM analysis enclosure On/Off switch is located inside the door on the bottom right hand corner. Push switch to the "on" position to start system.

The unit will immediately run thru a self diagnostic mode. This may take up to 2 minutes. The user will know the system has passed all diagnostic test and is "ready" upon the green LED (located above on/off switch) flashing. If the green LED does not start to flash verify that proper power is connected to the unit and restart. If AC/Heater fan is running but the green LED still will not flash then call the factory immediately for help.

NOTE: After startup a warm-up time from 20 to 60 minutes (Depending upon ambient temp) is required for accurate measuements.

Analyzer operation can be confirmed by the green LED light flashing. The pocket pc can then be connected for viewing menus. Upon power up, the analyzer will perform a self-test routine. The test will take approximately 6 minutes.

4.2 Analyzer Operation

4.2.1 User Interface

The µCEM User Interface runs on a Pocket-PC with Windows CE operating system. It communicates with the µCEM via serial communication port. All input to the Pocket-PC is done using a pointing device that comes with the Pocket-PC. The Pocket PC can be plugged into two different ports. The first port is located on the front panel below the on/off switch inside the front door. The second port is from the bottom of the uCEM via J3 connector.

The pocket PC can be found behind the door behind the glass piece. Note that upon shipment the pocket PC may be located in a separate box.

To connect the pocket PC to the: µCEM via the inside connection.

1. Open µCEM door.
2. Plug RS232 plug into adapter located on front panel
3. Plug power supply cable into 5V adapter
4. Turn Pocket PC on
5. In order to assure no other windows are open press the reset button. Reset button is located on the back of the pocket PC.
6. Go to tools menu (Icon in upper left hand corner) and click on µCEMTS.
7. Unit will display data in 3 to 5 seconds. If unit does not show data in 3 to 5 seconds repeat procedure starting with number 5.

To connect the pocket PC to the: µCEM via the outside connection.

1. Plug the external COM cable into J3 circular connector on the bottom of the uCEM.
2. Plug pocket pc RS232 plug into the J1 on the external COM cable.
3. Plug power supply cable into 5V plug on the COM cable.
4. Turn Pocket PC on.
5. In order to assure no other windows are open press the reset button. Reset button is located on the back of the pocket PC.
6. Go to tools menu (Icon in upper left hand corner) and click on µCEMTS.
7. Unit will display data in 3 to 5 seconds. If unit does not show data in 3 to 5 seconds repeat procedure starting with number 5.

Note: The Pocket PC can by used on any MicroCEM TS analysis enclosure regardless of the MicroCEM units IP address.

4.2.2 µCEM Main Window

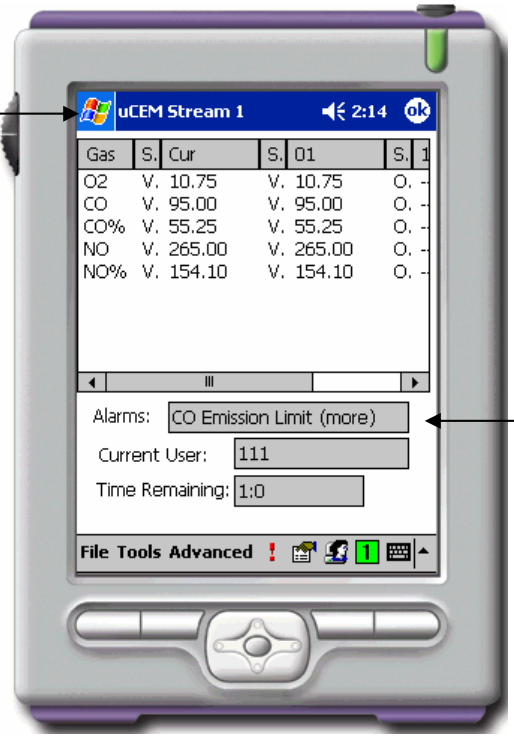
The µCEM Main Window shown in Figure 4-1 provides the status of the three emissions channels. The status includes the current reading (updated approximately every 2 seconds), the last 1-minute average, and the last 15-minute average. The status column (Sts) indicates the status of the measurement and can be any of the values in the Table 4-1.

Table 4-1 - Status Values

Shown in order of precedence. Maintenance mode status takes highest precedence.

Status	Description
M	Indicates that maintenance mode is active.
C	Calibration in process
I	Invalid Reading. Indicates that the reading is invalid due to calibration failure or Low Pressure flow alarm.
V	Valid Reading
P	Customer Process Off Line (Dry contact by cust)
B	System is in By-Pass mode (Stream Switch)
O	µCEM System powered off

Drag the edges of the columns to resize the columns


uCEM Stream 1
2:14
Gas S. Cur S. 01 S.
O2 V. 10.75 V. 10.75 O.
CO V. 95.00 V. 95.00 O.
CO% V. 55.25 V. 55.25 O.
NO V. 265.00 V. 265.00 O.
NO% V. 154.10 V. 154.10 O.
Alarms: CO Emission Limit (more)
Current User: 111
Time Remaining: 1:0
File Tools Advanced

Use the scrollbar to see the full set of data

Figure 4-1 - µCEM Main Display

4.2.3 µCEM Menus

Lower left part of the µCEM screen contains three menus, from which all of the µCEM user-interface functions can be accessed. There are three main menus: File, Tools and Advanced, presented on Figures 4-2.1, 4-2.2, and 4-2.3.

File Menu: Provides General access to Connect, Log-in, Log Off features

Tools Menu: Provides access to basic µCEM Tools, like alarms and stream switching

Advanced Menu: Provides access to advanced µCEM Features, like Stream Settings and User Administration

Toolbar Buttons: Shortcuts to Alarms, µCEM Settings, µCEM Admin, Stream Switching

Tools Menu: Provides access to all functionality

Note: Exit will only be available when current user has administrative access

Toolbar Buttons: Shortcuts to Alarms, µCEM Settings, µCEM Admin., Data Logs and About

Figure 4-2.1 - µCEM File Menu

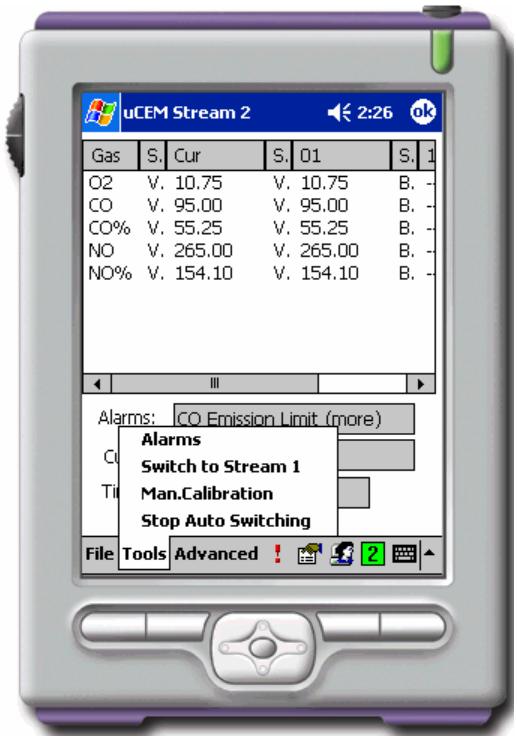


Figure 4-2.2 - µCEM Tools Menu

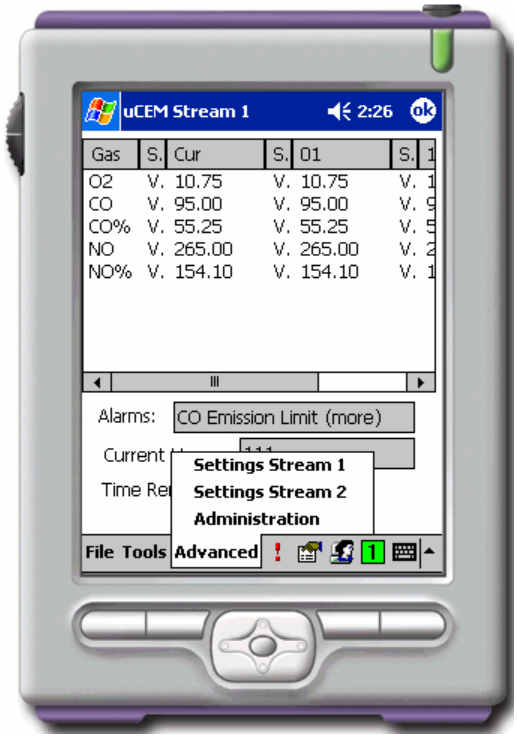


Figure 4-2.3 - µCEM Advanced Menu

4.2.4 µCEM Alarms

The µCEM Alarms dialog shows all the current alarms. A current alarm is one with an Active status of 1 (active) or an Acknowledged state of 0 (not acknowledged).. To see the historical Alarms for the last 3 months , the web based µCEM interface must be used. If one or more alarms are current, the most recent of them will be displayed on the main display. If more than one alarm is current "(more)" will be displayed after the name of the most recent alarm on the main window to indicate that more than one alarm is active. Horizontal scroll bar is be used to see Date and Time of the Alarms. Alarms can be General and Stream-specific. By selecting the radio buttons on the bottom, user can view different types of alarms.

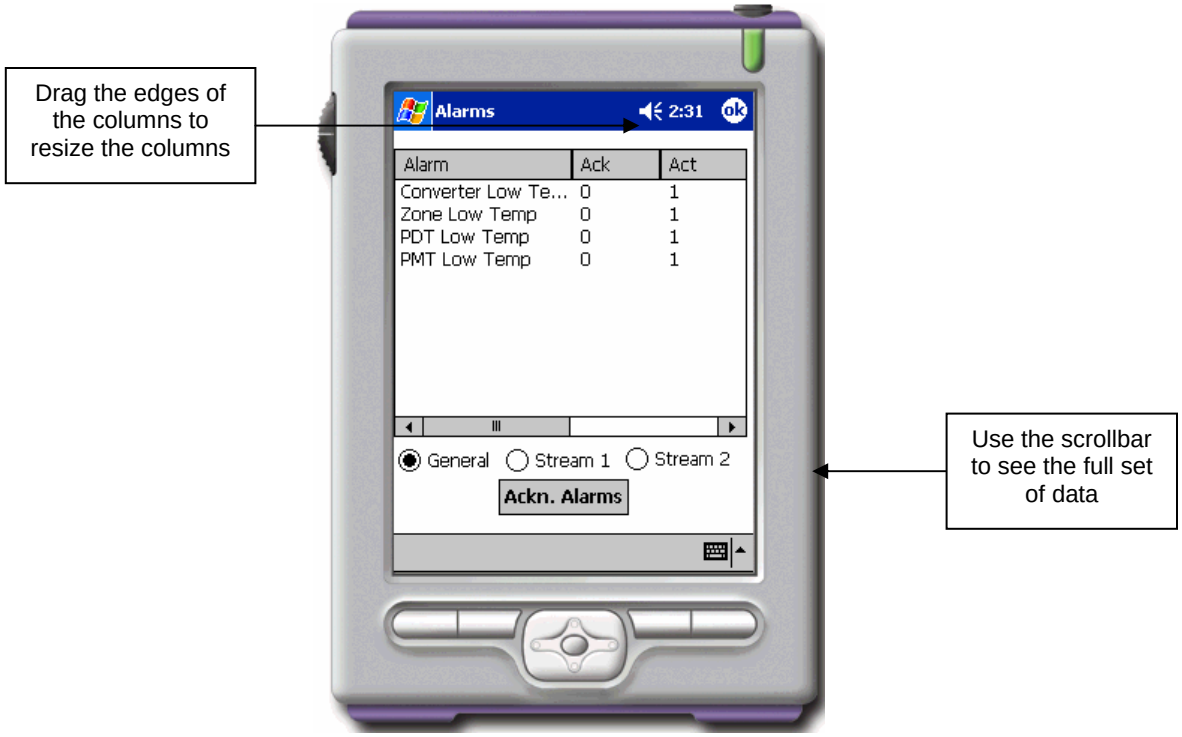


Figure 4-3. Pocket PC Alarms Screen

Alarms with a critical level will cause the System trouble output to become active when the alarm is active. When all active critical alarms are acknowledged, the System trouble output will become inactive.

Alarm Name	Level	Description	Type
O2 Calibration Failed	Critical	O2 Calibration Failed to meet the maximum Drift requirements	Stream Specific
CO Calibration Failed	Critical	CO Calibration Failed to meet the maximum Drift requirements	Stream Specific
NOx Calibration Failed	Critical	NOx Calibration Failed to meet the maximum Drift requirements	Stream Specific

O2 High Limit	Critical	O2 Sensor reading is above the minimal acceptable limit	Stream Specific
O2 Low Limit	Critical	O2 Sensor reading is below the minimal acceptable limit	Stream Specific
CO High Limit	Critical	CO Sensor reading is above the minimal acceptable limit	Stream Specific
CO Low Limit	Critical	CO Sensor reading is below the minimal acceptable limit	Stream Specific
NOx High Limit	Critical	NOx Sensor reading is above the minimal acceptable limit	Stream Specific
Nox Low Limit	Critical	NOx Sensor reading is below the minimal acceptable limit	Stream Specific
24V Over Max	Critical	24V diagnostic input exceeds the specified maximum	General
24 Low Min	Critical	24V diagnostic input is below the specified minimum	General
O2 Emission Limit	Warning	O2 reading is over the specified Limit	Stream Specific
CO Emission Limit	Warning	CO reading is over the specified Limit	Stream Specific
NOx Emission Limit	Warning	NOX reading is over the specified Limit	Stream Specific
Converter Over Temp	Critical	Converter temperature reading exceeds the specified maximum	General
Converter Low Temp	Critical	Converter temperature reading is below the specified minimum	General
Zone Over Temp	Critical	Zone temperature reading exceeds the specified maximum	General
Zone Low Temp	Critical	Zone temperature reading is below the specified minimum	General
PDT Over Temp	Critical	Peltier Cooler (PDT) temperature reading exceeds the specified maximum	General
PDT Low Temp	Critical	Peltier Cooler (PDT) temperature reading is below the specified minimum	General
PMT Over Temp	Critical	PDD Chamber temperature reading exceeds the specified maximum	General
PMT Low Temp	Critical	PDD Chamber temperature reading is below the specified minimum	General
Low Pressure	Critical	Low Sample Flow Pressure is detected (Below 2.5psi)	Stream Specific
Warmup Time Limit	Critical	System Warm-up process exceeded the specified time limit	General

Table 4-2 – Alarm Summary

4.2.5 µCEM Login

The login dialog appears (Figure 4-4) when first requesting the µCEM Settings or µCEM Admin. If a valid user name and password are entered, the user logging in will have permission to use the µCEM Settings and/or the µCEM Administration (Refer to the User Settings page of the µCEM Settings dialog). After logging in the first time, it is not required again until the user logs out, or is logged out automatically because of a period of inactivity (Refer to the Auto Logout page of the µCEM Administration dialog).

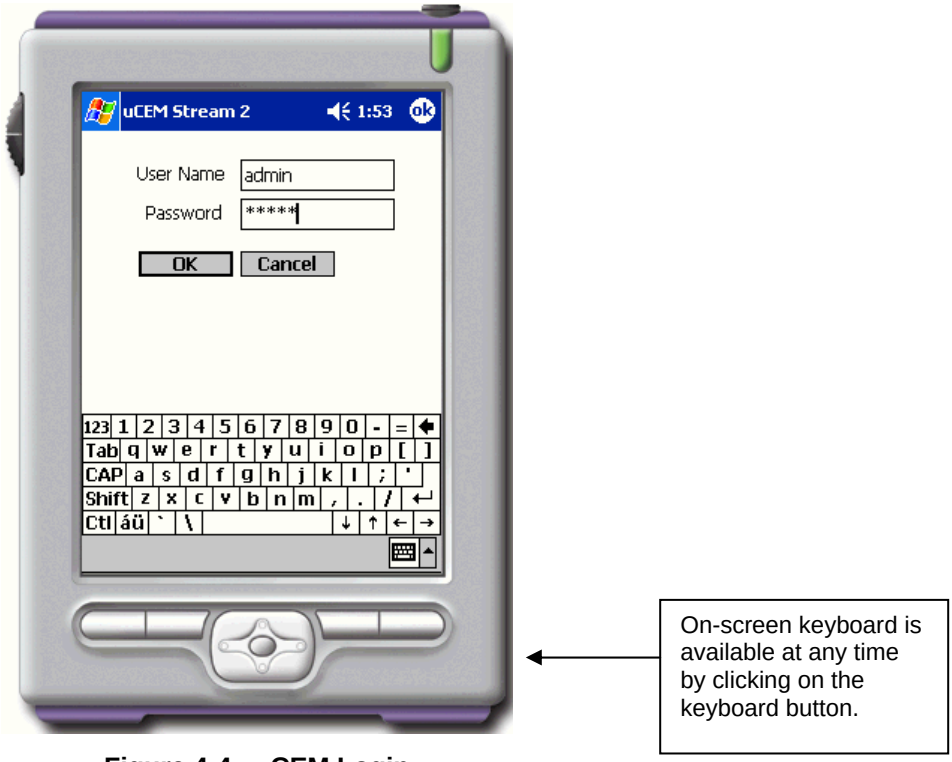


Figure 4-4 - µCEM Login

4.2.6 µCEM Login-Current User Indication

When a user is logged in, the µCEM main display will indicate the user name of the logged in user as shown in Figure 4-5.

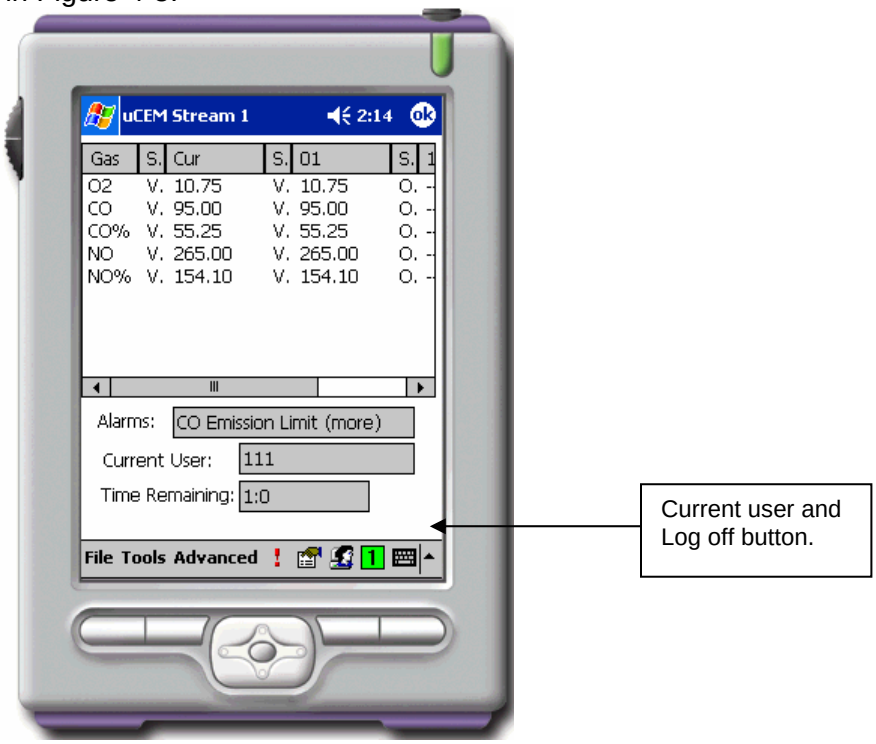

uCEM Stream 1
2:14
ok
Gas S. Cur S. 01 S. 1
O2 V. 10.75 V. 10.75 O. --
CO V. 95.00 V. 95.00 O. --
CO% V. 55.25 V. 55.25 O. --
NO V. 265.00 V. 265.00 O. --
NO% V. 154.10 V. 154.10 O. --
Alarms: CO Emission Limit (more)
Current User: 111
Time Remaining: 1:0
File Tools Advanced
Current user and Log off button.

Figure 4-5 - Current User Indication

4.2.7 Stream Switching Control

Typically a dual stream system is in Automatic Stream Switching mode. That means that it runs the timing schedule specified in User Settings Configuration file. If Automatic switching is not desirable, the user may turn it off using Tools-> Stop Auto Switching menu. In this case the system will remain on the current stream indefinitely. When Automatic switching is needed again, user may turn it back on with Tools->Start Auto Switching menu.
The same task can be accomplished remotely, by clicking Stop Auto Switching button on the µCEM Real-Time Web page.
Note, that this option is sustained even if the system is rebooted.

The operator may also force a switch between the streams at any time whether the system is in Auto-Switching mode or not. Tools menu has an option “Switch to StreamName”, where StreamName is a user-specified name of the stream.
The same task can be accomplished remotely by clicking Switch to “StreamName” button on the µCEM Real-Time Web page.

4.3 μCEM Settings

The μCEM Settings dialog is only available to users with μCEM Settings permission. If a user is not currently logged in, the login dialog will be displayed. If the current user doesn't have μCEM Settings permission, μCEM will not allow Settings screen to appear. When the μCEM Settings are invoked from the Advanced menu or the μCEM Settings button, the μCEM Settings tabbed dialog is displayed. The Range page (tab) is displayed initially.

4.3.1 μCEM Settings-Range

The Range Settings page is used to specify the range for the analog outputs. **Setting Range 2 to a value of 0 (zero) enables single range functionality and disables the dual range function.** For Dual Range applications do not set range 2 equal too or higher than Range 1 or the system will not calibrate properly. Note that Range 1 can be changed by the user but must be changed in the webrowser tools. See the Webrowser user settings section.

The dual range setting will enable the analyzer software and diagnostics to perform two separate performance curves for each range thus enhancing the measuring capabilities of the analyzer. A dual range setting is desired for applications burning dual fuels or that may display high dynamic reading between the low and high of the day. The analog outputs will also support the dual range mode. When the emission is below the Range 2 value, the analog output will switch to Range 2 mode and the Range 2 value becomes the full-scale value of the analog output. The range indication digital output will change to the Range 2 state. When the emission is above the Range 2 value, the output switches to Range 1 mode and the Range 1 value becomes the full-scale value of the output. The range indication digital output will change to the Range 1 state.

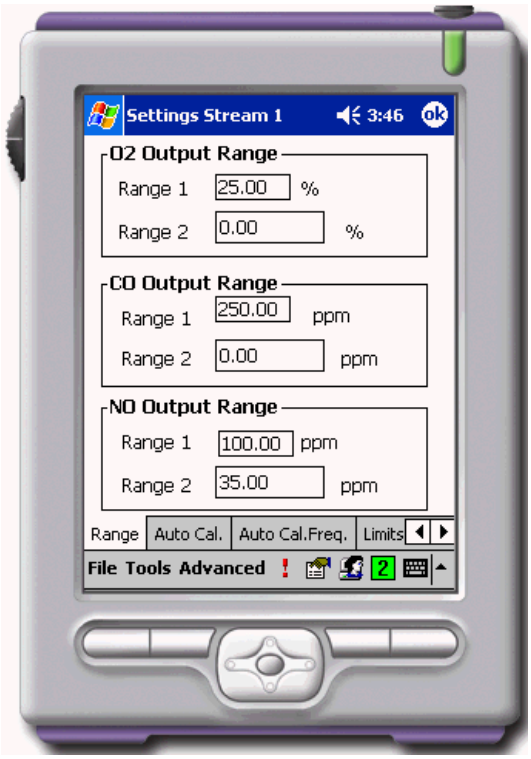


Figure 4.6 - Range Settings

4.3.2 µCEM Settings-Auto Calibration

The Auto-Calibration settings are set on the Auto-Calibration page of the µCEM settings. If auto calibration is turned to the on position, then the user can select time and/or frequency of the auto calibration in the Auto Calibration Frequency tab (4.3.3).
Note: Both manual and auto calibration need to be perform with the MicroCEM enclosure door in the closed position. If the door is opened then critical detector temperatures will vary which will cause a drift in the calibration. If the door is kept open long enough for temps to be constant at their setpoints then an open door calibration is acceptable. See section 4.7 “temp diagnostics”- for details on temperature setpoints.

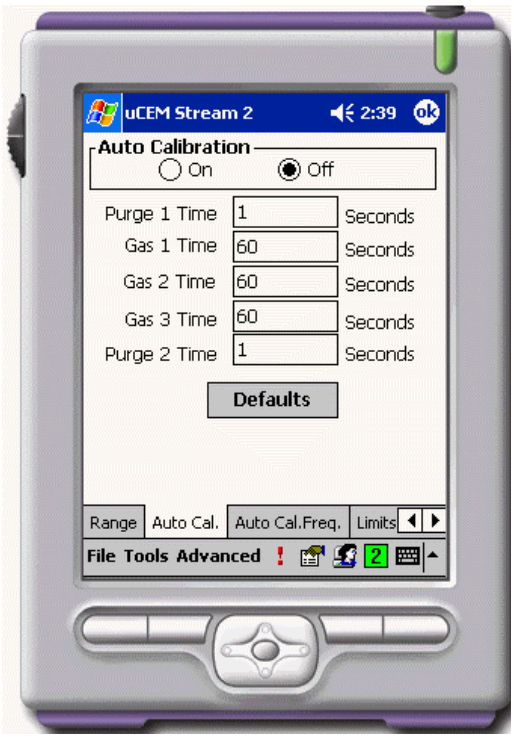


Figure 4.7 - Auto Calibration Settings

4.3.3 µCEM Settings - Auto Calibration Time and Frequency

The Auto-Calibration Time and Frequency tab allows specifying time and frequency of the auto-calibration. Time field requires military time format. The times are displayed in Military time type.

Figure 4.8 - Auto Calibration Time and Frequency

4.3.4 µCEM Settings-Limits

The emission limits alarms can be set on the Limits page of the µCEM Settings. When a measured emission exceeds its limit, the emission will have a limit-exceeded status. This is indicated on the main display and on the Data-Logs display. It is also indicated in the limit exceeded digital output.

Figure 4.11 - Limit Settings

4.3.5 μCEM Settings-Calibration Gas

The Calibration Gas values and Gas Bottle allocation may be set on the Calibration Gas page of the μCEM Settings. This should be set whenever a Calibration Gas container is replaced or upon Startup of the system.

Calibration Gas Values:
R1Mid: This is typically used for CGA audits and not for daily calibrations. The specific calibration gas mid value (typically between 40% to 60% of range) is set in this space. The MicroCEM will perform mid calibration on Range 1 on this gas but will not perform any corrections. This box should typically be left blank. It is mostly used as a check.
R1Span: The specific calibration gas span value (typically between 80% to 100% of range) is set in this space for Range 1. A Nox range of 0-100ppm would typically use a gas bottle with 90ppm NOx balance N2.
R2Mid: This is typically used for CGA audits and not for daily calibrations. The specific calibration gas mid value (typically between 40% to 60% of range) is set in this space. The MicroCEM will perform a mid calibration on Range 2 on this gas but will not perform any corrections. This box should typically be left blank. It is mostly used as a check.
R2Span: The space is allocated for dual range applications. If the MicroCEM range setting is set for single range then the user will not be able to input any value into this space. The specific calibration gas span value (typically between 80% to 100% of range) is set in this space. A Nox range of 0-10ppm would typically use a gas bottle with 9ppm NOx balance N2.

Note that zero values do not have to be input into this page. For all zero calibrations the user must assure that the calibration gas used does not have any levels of the measurement gas in the cylinder. For example upon the analyzer zeroing O2, the bottle used must have 0% O2 in the Bottle. Zeroing the O2 is typically performed by using the NOx or CO Span gases.

Gas Bottle Allocation:
Gas 1, Gas 2 and Gas 3 are labels for the respective location of where the calibration gas cylinders are physically located on the external fittings.

Off: Designates that no operation will be performed.
Zero: The MicroCEM will perform a zero calibration.
R1Span: MicroCEM will perform a Span calibration for Range 1.
R2Span: MicroCEM will perform a Span calibration for Range 2. Note that if a second range is NOT chosen in the range settings menu then user will not be able to input any value into this space. Range 2 should always be a lower value than range 1 if used.
R1Mid: MicroCEM will perform a Mid Calibration for Range 1.
R2Mid: MicroCEM will perform a Mid Calibration for Range 2. Note that if a second range is NOT chosen in the range settings menu then user will not be able to input any value into this space.

Figure 4.12 - Calibration Gas Settings

4.3.6 µCEM Settings-Maintenance Mode

Maintenance mode may be selected for any of the emission types on the Maintenance Mode page of the µCEM Settings.
Choosing maintenance mode will invoke an “M” flag” onto the data. Customer can perform routine maintenance while in this setting
This mode is typically used when preventive maintenance is being performed. The M flag signifies to the EPA that the values reported are not valid therefore should not be applied to emissions reporting.
Upon completion of Maintenance the user must go back into this screen to turn the Maintenance off. If not, the MicroCEM will continue to show the M flag in the data.

Figure 4.13 - Maintenance Mode Settings

4.3.7 µCEM -Manual Calibration

A dry-run Calibration may be initiated from the Manual Calibration page of the µCEM Settings by pressing the Manual Calibrate All icon. A full zero and span calibration will be run by the MicroCEM but the end result corrections of the calibration will not be applied to the O2/Nox/CO measurement values. If desired a partial calibration may be invoked for one or more of the emission types. While the manual calibration is in process, a calibration progress dialog will be displayed as shown in Figure 4.24. When the manual calibration is completed, the results are displayed in the Manual Calibration Results dialog as shown in Figure 4.10. If the Local Calibration checkbox is checked, the Local Calibration valve will be used during the calibration rather than the probe Calibration valve.
Note that “Start Auto Cal now” will invoke a calibration and will apply new correction factor to all measurement when done.

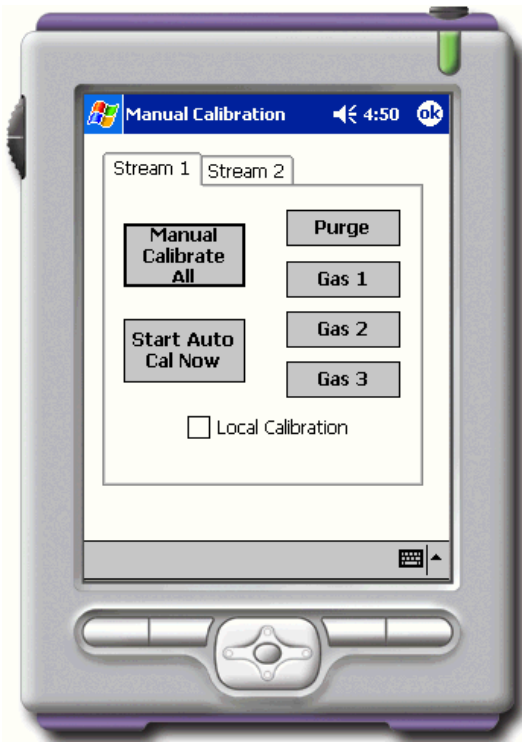


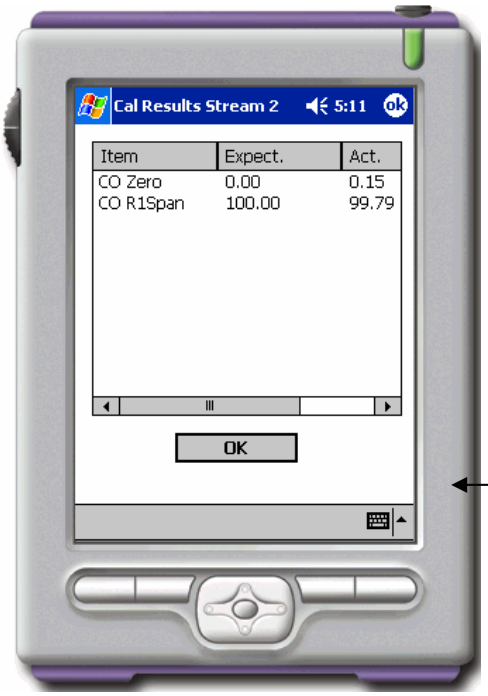
Figure 4.9 - Manual Calibration Menu

4.3.8 Auto Calibration

The Auto Calibration dialog is displayed whenever calibration is in process. It displays the current emission values and the status of the calibration. The calibration may be canceled before it completes by pressing the Cancel button.

Note: The title of this dialog will read either “Auto Calibration” or “Manual Calibration” to indicate how the calibration process was initiated.

Figure 4.22 - Auto Calibration Status Screen



Use the scrollbar to see the full set of results

Figure 4.10 - Manual Calibration Results

4.4 µCEM Administration

The µCEM Administration dialog is only available to users with µCEM Administration permission. If a user is not currently logged in, the login dialog will be displayed. If the current user doesn't have µCEM Administration permission, a message will be displayed which reads "Permission denied". When the µCEM Administration is invoked from the Tools menu or the µCEM Administration button, the µCEM Administration tabbed dialog is displayed. The User Settings page (tab) is displayed initially.

4.4.1 µCEM Administration-User Settings

The user settings page of the µCEM Administration dialog allows users to be added, deleted or modified. Each user has a name, password, and permission settings. The permission settings include Settings permission that allows access to the µCEM Settings dialog, and Administrative permission that allows access to the µCEM Administration dialog. The Settings permission also allows a user to access the µCEM remotely using the web-based interface.

Figure 4.14 - User Settings

4.4.2 µCEM Administration-Auto Logoff

The number of minutes of inactivity after which a user is automatically logged off is set on the Auto Logoff page of the µCEM Administration.

Figure 4.15 - Auto Logoff

4.5 μCEM Factory and User Settings

A μCEM Factory and User Settings files are available for use by μCEM technicians to set parameters in the μCEM or a qualified customer technician.
μCEM Settings are separated into two files: Factory Settings and User Settings. Factory Settings should be modified by a Rosemount technician only. Note: Some parameters in this file, if set incorrectly, may cause permanent damage to hardware.

User Settings can be modified by a qualified customer technician. User settings are accessible through the User Settings Web screen. See section 4.7 for details on access. Settings files are formatted as a standard Windows INI files. File is organized in sections (in square brackets). Configuration Parameters are presented in "Name = Value" format. Comments start with semicolon. User Settings files has three sections [General], [Stream 1] and [Stream 2].
The list of some settings is shown in Table 4.3 & Table 4.4.
Consult a Rosemount factory person for details.

Table 4.3 - [General] section

Calibration Setting	Description
Stream1Time	Stream 1 processing time in minutes when auto switching
Stream2Time	Stream 2 processing time in minutes when auto switching
TransitionTime	Time to keep the B flag after the switch have occurred, in seconds
Stream1Name	Stream 1 Name to be shown on Pocket PC and Web pages
Stream2Name	Stream 2 Name to be shown on Pocket PC and Web pages
CalibrationCurrentLoopOutputs	Defines the behavior of Current Loops during Calibrations 1 - Hold the Last Good Value, 2 - Use the User-Specified Value 3 - Follow the Gases as is
CalibrationCurrentLoopOutputsUserValue	Value in milliamps. Used when the previous parameter is set to 2
ByPassCurrentLoopOutputs	Defines the behavior of Current Loops during By-Pass 1 - Hold the Last Good Value 2 - Use the User-Specified Value
ByPassCurrentLoopOutputsUserValue	Value in milliamps. Used when the previous parameter is set to 2
AutoCalForcesSwitch	Defines what to do, when the scheduled Auto-Calibration time comes, but the system happens to process another stream 1 - force a switch to the stream and run the Calibration 2 - wait until the stream is switching occures by itself and run the Calibration
DigitalOutputsLogic	Defines how to control Digital Outputs 1- O2 Limit, CO Limit, NOX Limit Logic 2- Valid, In Calibration, In Maintenance

Table 4.4 - [Stream X] section

Stream Setting	Description	
DiluentCorrectionPercent	Diluent Correction Percent used in calculations for the Stream	
O2R1Range	Range 1 Setting for O2 (Range 2 can be changed from the Pocket PC)	
COR1Range	Range 1 Setting for CO (Range 2 can be changed from the Pocket PC)	
NOXR1Range	Range 1 Setting for NOx (Range 2 can be changed from the Pocket PC)	
PostCalibrationDelay	Number of seconds to keep the C(Calibration) flag after the Auto Calibration process is over	
R1O2ZeroDriftLimit	O2 Allowed Zero Drift Limit for Range 1.	If the drift exceeds the allowed amount a drift alarm will occur, and the readings on the channel will no longer be valid until a successful calibration is completed.
R1COZeroDriftLimit	CO Allowed Zero Drift Limit for Range 1.	
R1NOXZeroDriftLimit	NOx Allowed Zero Drift Limit for Range 1.	
R1OSMidDriftLimit	O2 Allowed Mid Drift Limit for Range 1.	
R1COMidDriftLimit	CO Allowed Mid Drift Limit for Range 1.	
R1NOXMidDriftLimit	NOx Allowed Mid Drift Limit for Range 1.	
R1O2SpanDriftLimit	O2 Allowed Span Drift Limit for Range 1.	
R1COSpanDriftLimit	CO Allowed Span Drift Limit for Range 1.	
R1NOXSpanDriftLimit	NOx Allowed Span Drift Limit for Range 1.	
R2O2ZeroDriftLimit	O2 Allowed Zero Drift Limit for Range 2.	If the drift exceeds the allowed amount a drift alarm will occur, and the readings on the channel will no longer be valid until a successful calibration is completed.
R2COZeroDriftLimit	CO Allowed Zero Drift Limit for Range 2.	
R2NOXZeroDriftLimit	NOx Allowed Zero Drift Limit for Range 2.	
R2OSMidDriftLimit	O2 Allowed Mid Drift Limit for Range 2.	
R2COMidDriftLimit	CO Allowed Mid Drift Limit for Range 2.	
R2NOXMidDriftLimit	NOx Allowed Mid Drift Limit for Range 2.	

R12O2SpanDriftLimit	O2 Allowed Span Drift Limit for Range 2.	
R2COSpanDriftLimit	CO Allowed Span Drift Limit for Range 2.	
R2NOXSpanDriftLimit	NOx Allowed Span Drift Limit for Range 2.	

4.6 *uCEM Data Logs*

The µCEM maintains a minimum of 3 months of history in three types of data log files. The first type of log file is the measurement log, which contains emission measurements (at 1 minute intervals), alarm indications and maintenance mode indications. The second type of log file is the calibration log file, which contains information on each auto calibration done. The third is the alarm log file, which records any improperly functioning hardware. The data will be stored in flat, ASCII, CSV (comma-delineated) files. This file format can be read directly by MS Excel and imported into many types of software applications. The following parameters are factory set for each of the log file types.

4.6.1 Maximum Log File Size

This is how large a log file can get (in bytes) before it is closed and a new log file is opened.

Emissions Log:	1 MB
Calib Log:	4000 bytes
Alarm Log:	4000 bytes

4.6.2 Maximum Number of Log Files

This is how many log files can be created. When the maximum number of log files is reached, the oldest file is overwritten when new ones are created.

Emissions Log:	6
Calib Log:	6
Alarm Log:	6

4.6.3 Log File Name Format

The log file name uses the date that the file was created. It is of the format *TYYYYMMDD*.CSV where *T* is the log file type (E=Emissions, C=Calibration and A=Alarm), *YYYY* is the Year, *MM* is the month, and DD is the day of the month. For example, the file name **E20010329.csv** contains emissions data and was created on March 29, 2001.

4.6.4 Measurement Log File Format

The log file contains data in a flat, ASCII, CSV file. The following are the fields of the file, in order of occurrence. The log file size will be about 42 bytes per entry. 3 months of data logs will require about 5,443,200 bytes

Name	Description	Example
Date/Time	Month-day-year Hours:Minutes:Seconds	3-7-2001 10:24:00
O2	Percent O2 (percent)	10.5
O2 Limit	O2 Limit exceeded alarm, 0=inactive, 1=active	0
O2 Status	V=Valid, M=Maintenance Mode, C=Calibration in process, I=Invalid (calibration failed or sensor in failed state)	V
CO	CO parts per million	12
CO Limit	CO Limit exceeded alarm, 0=inactive, 1=active	0
CO Status	V=Valid, M=Maintenance Mode, C=Calibration in process, I=Invalid (calibration failed or sensor in failed state)	V
Nox	NOx parts per million	15
NOx Limit	NOx Limit exceeded alarm, 0=inactive, 1=active	0
NOx Status	V=Valid, M=Maintenance Mode, C=Calibration in process, I=Invalid (calibration failed or sensor in failed state)	V

Table 4.7 –Measurement Log File Format

4.6.5 Calibration Log File Format

The log file contains data in a flat, ASCII, CSV file. The following are the fields of the file, in order of occurrence. The log file size will be about 350 bytes per entry. 3 months of data logs will require about 32000 bytes (based on Calibration performed every 24 hours).

Name	Description	Example
Date/Time Calibration start	Month-day-year Hours:Minutes:Seconds	3-7-2001 10:24:57
Gas 1 Time	Time that Gas 1 started, Hours:Minutes:Seconds	10:25:30
Gas 2 Time	Time That Gas 2 started, Hours:Minutes:Seconds	10:27:30
Gas 3 Time	Time that Gas 3 started, Hours:Minutes:Seconds	10:28:30
Purge Time	Time that the final purge started, Hours:Minutes:Seconds	10:30:30
Finish Time	Time that the final purge finishes	10:31:00
O2 Expected Zero	Expected percent O2 for Zero phase of calibration	0.0
O2 Measured Zero	Measured percent O2 for Zero phase of calibration	0.0
O2 Zero Drift	Percent drift of O2 zero calibration	0.0
O2 R1 Expected Mid Span	Expected percent O2 for Range 1 Mid span phase of calibration	10.0
O2 R1 Measured Mid	Measured percent O2 for Range 1 Mid span phase of	10.1

Span	calibration	
O2 R1 Mid Drift	Percent drift of O2 Range 1 mid calibration.	0.4
O2 R1 Expected Span	Expected percent O2 for Range 1 Span phase of calibration	20.2
O2 R1 Measured Span	Measured percent O2 for Range 1 Span phase of calibration	20.3
O2 R1 Span Drift	Percent drift of O2 Range 1 span calibration	0.4
O2 R2 Expected Mid Span	Expected percent O2 for Range 2 Mid span phase of calibration	10.0
O2 R2 Measured Mid Span	Measured percent O2 for Range 2 Mid span phase of calibration	10.1
O2 R2 Mid Drift	Percent drift of O2 Range 2 mid calibration.	0.4
O2 R2 Expected Span	Expected percent O2 for Range 2 Span phase of calibration	20.2
O2 R2 Measured Span	Measured percent O2 for Range 2 Span phase of calibration	20.3
O2 R2 Span Drift	Percent drift of O2 Range 2 Span calibration	0.4
CO Expected Zero	Expected ppm CO for zero phase of calibration	1
CO Measured Zero	Measured ppm CO for zero phase of calibration	0
CO Zero Drift	Percent drift of CO zero calibration	-0.3
CO Expected R1 Mid Span	Expected ppm CO for Range 1 mid span phase of calibration	23
CO Measured R1 Mid Span	Measured ppm CO for Range 1 mid span phase of calibration	24
CO R1 Mid Span Drift	Percent drift of CO Range 1 mid span calibration	0.3
CO R1 Expected Span	Expected ppm CO for Range 1 span phase of calibration	45
CO R1 Measured Span	Measured ppm CO for Range 1 span phase of calibration	45
CO R1 Span Drift	Percent drift of CO Range 1 span calibration	0
CO Expected R2 Mid Span	Expected ppm CO for Range 2 mid span phase of calibration	23
CO Measured R2 Mid Span	Measured ppm CO for Range 2 mid span phase of calibration	24
CO R2 Mid Span Drift	Percent drift of CO Range 2 mid span calibration	0.3
CO R2 Expected Span	Expected ppm CO for Range 2 span phase of calibration	45
CO R2 Measured Span	Measured ppm CO for Range 2 span phase of calibration	45
CO R2 Span Drift	Percent drift of CO Range 2 span calibration	0
NOx Expected Zero	Measured ppm NOx for zero phase of calibration	15
NOx Measured Zero	Expected ppm NOx for zero phase of calibration	15
NOx Zero Drift	Percent drift of NOx zero calibration	0
NOx Expected R1 Mid Span	Measured ppm NOx for Range 1 mid span phase of calibration	30
NOx Measured R1 Mid Span	Measured ppm NOx for Range 1 mid span phase of calibration	30
NOx R1 Mid Span Drift	Percent drift of NOx Range 1 mid span calibration	0
NOx Expected R1 span	Measured ppm NOx for Range 1 span phase of calibration	59
NOx Measured R1 span	Measured ppm NOx for Range 1 span phase of calibration	59

NOx R2 Span Drift	Percent drift of NOx Range 1 span calibration	0
NOx Expected R2 Mid Span	Measured ppm NOx for Range 2 mid span phase of calibration	30
NOx Measured R2 Mid Span	Measured ppm NOx for Range 2 mid span phase of calibration	30
NOx R2 Mid Span Drift	Percent drift of NOx Range 2 mid span calibration	0
NOx Expected R2 span	Measured ppm NOx for Range 2 span phase of calibration	59
NOx Measured R2 span	Measured ppm NOx for Range 2 span phase of calibration	59
NOx R2 Span Drift	Percent drift of NOx Range 2 span calibration	0

Table 4.8 – Calibration Log File Format

4.6.6 Alarm Log File Format

The log file contains data in a flat, ASCII, CSV file. The following are the fields of the file, in order of occurrence. The days or months maintained in the Alarm Log depends on how often trouble conditions are recorded. If alarms rarely occur, there is enough space for many years of alarm logs to be recorded.

Name	Description	Example
Date/Time	Month-day-year Hours:Minutes:Seconds	3-7-2001 10:24:57
Fault Level	1=informational, 2=warning, 3=critical	3
Fault Type	0 = O2 Calibration Failed 1 = CO Calibration Failed ** 2 = NOx Calibration Failed 3 = O2 High Limit 4 = O2 Low Limit 5 = CO High Limit ** 6 = CO Low Limit ** 7 = NOx High Limit 8 = NOx Low Limit 9 = O2 Emission Limit 10 = CO Emission Limit ** 11 = NOx Emission Limit 12 = 5 Volt Fault ** 13 = 6 Volt Fault ** 14 = 24V Over Max 15 = 24 Low Min 16 = Converter Over Temp 17 = Converter Low Temp 18 = Converter On Failed ** 19 = Converter Off Failed ** 20 = Zone Over Temp 21 = Zone Low Temp 22 = Zone Heater On Failed ** 23 = Zone Heater Off Failed **	2

	24 = Zone Cooler On Failed ** 25 = Zone Cooler Off Failed ** 26 = Heater Fan On Failed ** 27 = Heater Fan Off Failed ** 28 = Cooler Fan On Failed ** 29 = Cooler Fan Off Failed ** 30 = PDT Over Temp 31 = PDT Low Temp 32 = PDT On Failed ** 33 = PDT Off Failed ** 34 = PMT Over Temp 35 = PMT Low Temp 36 = PMT On Failed ** 37 = PMT Off Failed ** 38 = O2 Over Temp ** 39 = O2 Low Temp ** 40 = O2 On Failed ** 41 = O2 Off Failed ** 42 = Warmup Time Limit 55 = Low Pressure 70 = IO Board Failed 71 = Disk Failure 72 = Network Failure	
Fault Description	ASCII string describing fault. Up to 200 characters.	CO Calibration Failed

Table 4.9 – Alarm Log File Format

** - Alarm is not implemented in this version of software or reserved for the future use

4.6.7 Accessing the Real-Time ACSII Data String via Ethernet TCP/IP (DAS)

Remote Real-time data acquisition from the uCEM is done through the TCP/IP enabled network via the HTTP (Web transport) protocol.
Acquisition software has to request the page form the Web Server running on the uCEM unit with the desired frequency (real update time is 1 sec).
URL for the real time data is defined as such: http://[uCEM IP]/fetchData.asp
For example: http://127.0.0.1/ fetchData.asp
In response Web Server will return the comma-delimited string that contains current analyzer data. Note: the response is a plain text not the HTML document.
If the actual analyzer software is running, the response data will be formatted as such:

DateTime,O2CurrentValue,O2CurAlarms,O2Status,O21MinAverage,O21MinStatus,O215MinAverage,O215MinStatus,COCurValue,COCurAlarms,COCurStatus,CO1MinAverage,CO1MinStatus,CO15MinAverage,CO15MinStatus,NOxCurValue,NOxCurAlarms,NoxCurStatus,NOx1MinAverage,NOx1MinStatus,NOx15MinAverage,NOx15MinStatus,ExtProcess1,ExtProcess2,DigInput1,DigInput2,DigInput3; AlarmsString

The result is a single string of data.
DateTime is formatted as such: Month-Day-Year4Digits HoursMilitary:Minutes:Seconds
Example: 02-05-2002 14:58:53
All the current and average gas values are the floating-point numbers and may contain a sign. Certain rules are defined for the current and average gas values:
If there is a "#" sign in this field – data for this field are not valid. That usually means there is no data available or the data cannot be converted to the string representation (due for example to faulty Calibration).
If the value field shows – "-555.00" (negative 555.00). That is a "magic number" that denotes that the system haven't yet initialized the data. That usually happens when uCEM starts up and 1 minute or 15-minute averages are not yet available (calculated). Note that regardless of the status, values show the current measured data from the analyzer. "Magic number" means that the data (usually 15 minute averages) have not been yet calculated.
ExtProcess1 and **ExtProcess2** are the values of the Analog Inputs (Mega Watts and Fuel Flow usually).
DigInput1, **DigInput2**, **DigInput3**- show the state of the digital inputs and can take a value of either 1(On) or 0(Off). DigInput1 is usually interpreted as ProcessOn. DigInput2 – as FlameOn. DigInput3 – as Shutdown.
CurAlarms values show the current state of the emissions limit alarm associated with the gas. It's an integer number that equals to 1 when emission limit for the gas is exceeded and stays 0 if the gas doesn't gave associated alarm active.

All the **Status** values are single-character values. Status is defined as such:
V – Valid
I – Invalid

M – Maintenance
C – Calibration
P – Process Off
O – uCEM Off

AlarmsString – is a string data that describes the current Alarms situation with the uCEM module. It is separated from the rest of the data by a semi-colon. AlarmsString usually is not parsed and used for the presentation purposes only. Example: "1,NOx Emission Failed. 13 More ..."

Example:

02-05-2002 14:58:53,21.44,1,V,20.09,V,-555.00,V,##.##,0,P,##.##,P,##.##,P,10.37,1,I, 12.45,I,-555.00,I,5.0,3.76,0,1,0;1,NOx Emission Failed. 13 More ...

This string means that the sample was taken February 5 2002 at 2:58PM, O2 values were all Valid except the 15 Minutes average was not yet calculated, CO process was Off - the data were not available. NOX data were Invalid and the 15 Minutes average was not yet calculated. Mega Watts value read from the input was 5.0, Fuel Flow – 3.76
DigInput1(ProcessOn) is set to 0(Off), DigInput2(FlameOn) is set to 1 (On), DigInput3(Shutdown) is set to 0 (Off)
There were also 13 alarms active, NOx Emission Failed being the most recent one.

If the uCEM analyzer is not currently running the return string will be:
"uCEM is not running. No data Available."

4.7 Viewing Data via the Pocket PC Web Browser

The Pocket PC Web Browser menu can be accessed via the pocket pc main menu. In the top upper left hand corner of the menu the name of the unit will be displayed (ucem XXXX). Point on this name. A drop down menu will appear. Point on Internet Explorer. A sign on page will then be displayed. User name and password will be the identical as the normal names used on the administration settings. Very importantly the Web Browser function allows the user to access all data (calibrations, alarms, emission data logs, diagnostics) internally stored in the MicroCEM.

The Web Browser will show the following screens/options for the user. Note that these screens are updated once every 10 seconds unless the refresh bottom is pressed:
Real Time: This screen is identical to the main menu screen normally shown on the pocket pc.

Emissions: This screen will enable the user to view all internal emission data logs stored in the MicroCEM. User can choose between 1, 15, 1hr or 24 hour periods. A designated time frame or most recent data can be choses. The report generator will display data in a chart type format showing each gas value and associated time along with data flags. The function is very helpful in very historical data or performing trouble shooting.
Alarms: This screen will allow the user to display all alarms and time frames. User may choose time frames or most recent alarms.
Cal: Display of all calibrations with results can be viewed from this page.
User Config: This file contains user selectable files that are typically input at startup and never changed. See section 4.4 for details on descriptions. Note that reboot of the MicroCEM may be necessary for system to accept changed for several items in this file.
Factory Config: Do not access this file unless a certified Rosemount technician is present. Changes to this file may adversely affect or destroy the unit. Changes made to this file without the written consent of the MicroCEM Product Manager will void the warranty.
Download: User can easily download all data log files (Emissions, Alarms, Calibrations) stored in the MicroCEM. This is typically used when user is accessing the MicroCEM via a separate laptop or tabletop computer. See next section.
Temp Diag: Temperature diagnostics is a very important tool for diagnosing existing problems or potential issues/problems with the MicroCEM.
The following parameters will be shown: Temperature Parameter, Temp Setting, Actual Temp and Integral %.
*Zone Temperature: Zone temperature is typically set to 47 degrees C. This is the temperature of the MicroCEM taken from the detector section thermocouple that is located behind the pressure gauge. This thermocouple is always used for systems with no CO. For systems with CO a thermocouple is located on the CO assy detector. The MicroCEM will typically control temperature to within +/- 1 degree C. Depending upon the outside ambient temperature the % on time can be from 0 to 100% on. If a negative value is shown in the integral then cooling is in process. Variations greater than 1 degree C will lead to gas measurement drifting.
*PMD Temp: This is the Temperature of the chassis of the MicroCEM. Thermocouple is located in the PMD detector. Temperature is typically within 2 degrees C. of the zone. If the temperature drifts greater than this. Upon first turn on of the MicroCEM this temp can be monitored. Once this temp is within 2 degrees C of the Zone then the unit is ready for accurate measurements. Temperature above the 2 degree variance of the

zone may show than the AC/Heater unit fan may have failed or a possible defective thermocouple.
*PDD Temp: For systems with NOx a cylindrical NOx detector assy is located in the detector section. Internal to the detector assy a small peltier device is operating and must operate at 0 degrees C. The temperature should never deviate +/- .05 degrees C from the setpoint of zero or the NOx readings may drift. Integral will typically run between 40 to 70%.
*PMT Temp: This temperature is for the detector assy heater core. Setting is set to 52 degrees C. Temperature should not drift more than 0.2 degrees C or NOx drift may occur. Excessive temperature variation may be caused by either poor zone temperature control or a faulty heater.
*Conv Temp: This temperature is for the NOx converter assembly. Temperature setting is 330 degrees C. Temp should not vary more than 1 degrees C. or NOx measurements will drift. A faulty heater will cause temp variations.

Note that when the enclosure door is opened that all of the above temperature setting may be affected and will take a short about of time to react and control to the desired temperatures.

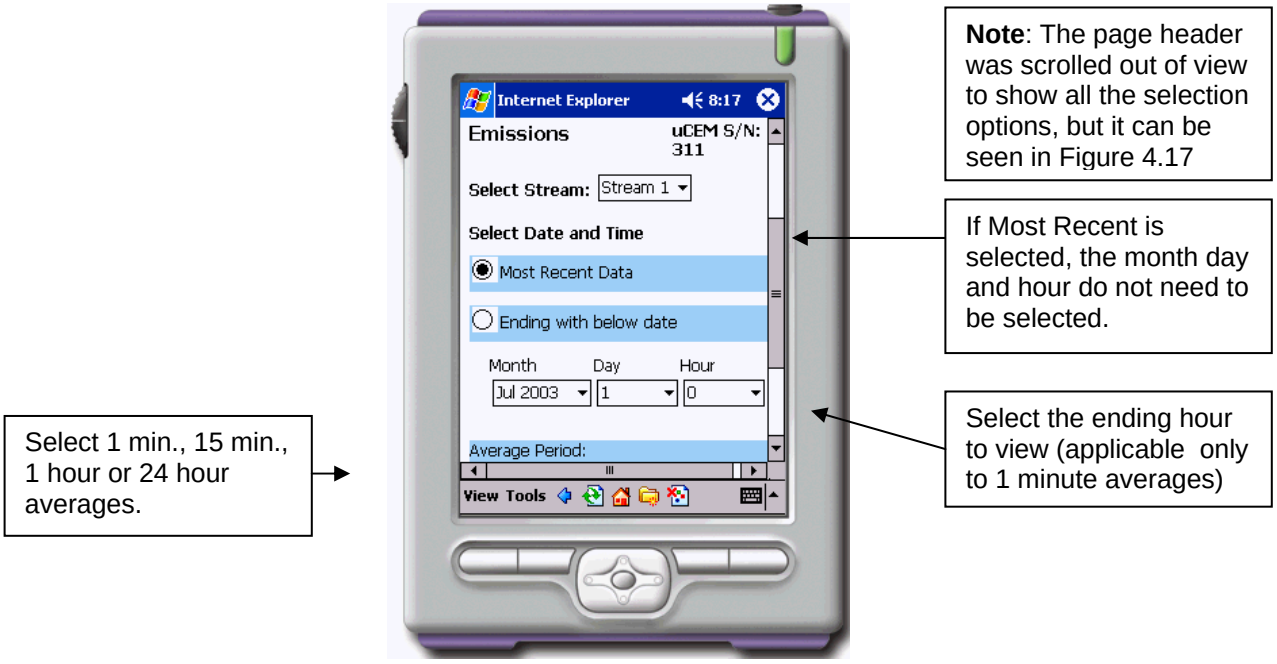
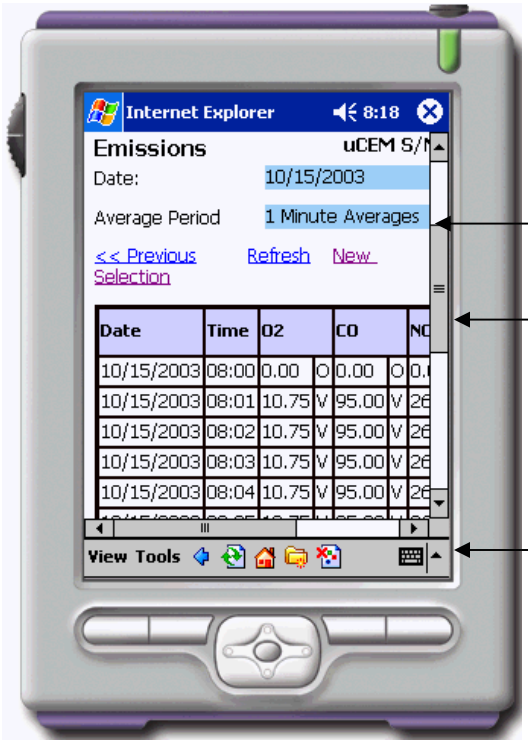

Internet Explorer
8:17
Emissions
uCEM S/N: 311
Select Stream:
Stream 1
Select Date and Time
Most Recent Data
Ending with below date
Month
Day
Hour
Jul 2003
1
0
Average Period:
View Tools
Note: The page header was scrolled out of view to show all the selection options, but it can be seen in Figure 4.17
If Most Recent is selected, the month day and hour do not need to be selected.
Select the ending hour to view (applicable only to 1 minute averages)
Select 1 min., 15 min., 1 hour or 24 hour averages.

Figure 4.16 - View Data Logs

Table 4.10 - Average Period Selection

Average Period	Time Range Displayed
1 Minute	1 Hour
15 Minutes	1 Day
1 Hour	3 Days
24 Hours	3 Months

Note: The Real-time, Config and Download are included in the navigation menu but these pages are intended for remote desktop use. As an enhancement these items could be hidden if the pages are browsed from a Windows CE version of Internet Explorer.



7Figure 4.17 - View Data Logs Table

4.8 Viewing μCEM Data with an external PC Web Browser

The MicroCEM internal log files may be accessed using a user PC or laptop with a web browser that has access to the μCEM over a LAN, serial port connection (PPP) or Dialup Connection (RAS). The μCEM has Window CE Web Server installed and provides a Web-based interface to select and download the Data-Log files. The downloaded Data-Log files will be in a CSV (comma delineated ASCII) format. The log files may also be viewed as a web page in a tabular format.

1. Connect user PC or laptop to the MicroCEM via Ethernet LAN circular connector located on J4 connector. The Ethernet cable can then be routed to the users Ethernet hub where as many PC's as desired can access the MicroCEM Web Browser. Customer may also choose to connect the cable directly to the Ethernet port located on the MicroCEMs PC104 PCB which is internal to the MicroCEM. Note that a crossover type Ethernet cable must be used if a hub is not utilized.
2. The user PC or laptop must have the same IP address as the MicroCEM or the MicroCEM IP address can be changed to the users desired IP address. Standard IP address of the MicroCEM is: **192.168.1.92**
3. Once the IP addresses are matched the user can simply open internet explorer on their computer and type is the MicroCEMs IP address.
4. Once entered a user ID and password must be entered. These are the identical user ID and password as input into the administration menus.
5. Once entered the user can then access all pages as specified in section 4.7.

4.8.1 Real-Time Page

The Real-Time page provides a real-time display of the emission values and emission statuses. The display is refreshed every 10 seconds.

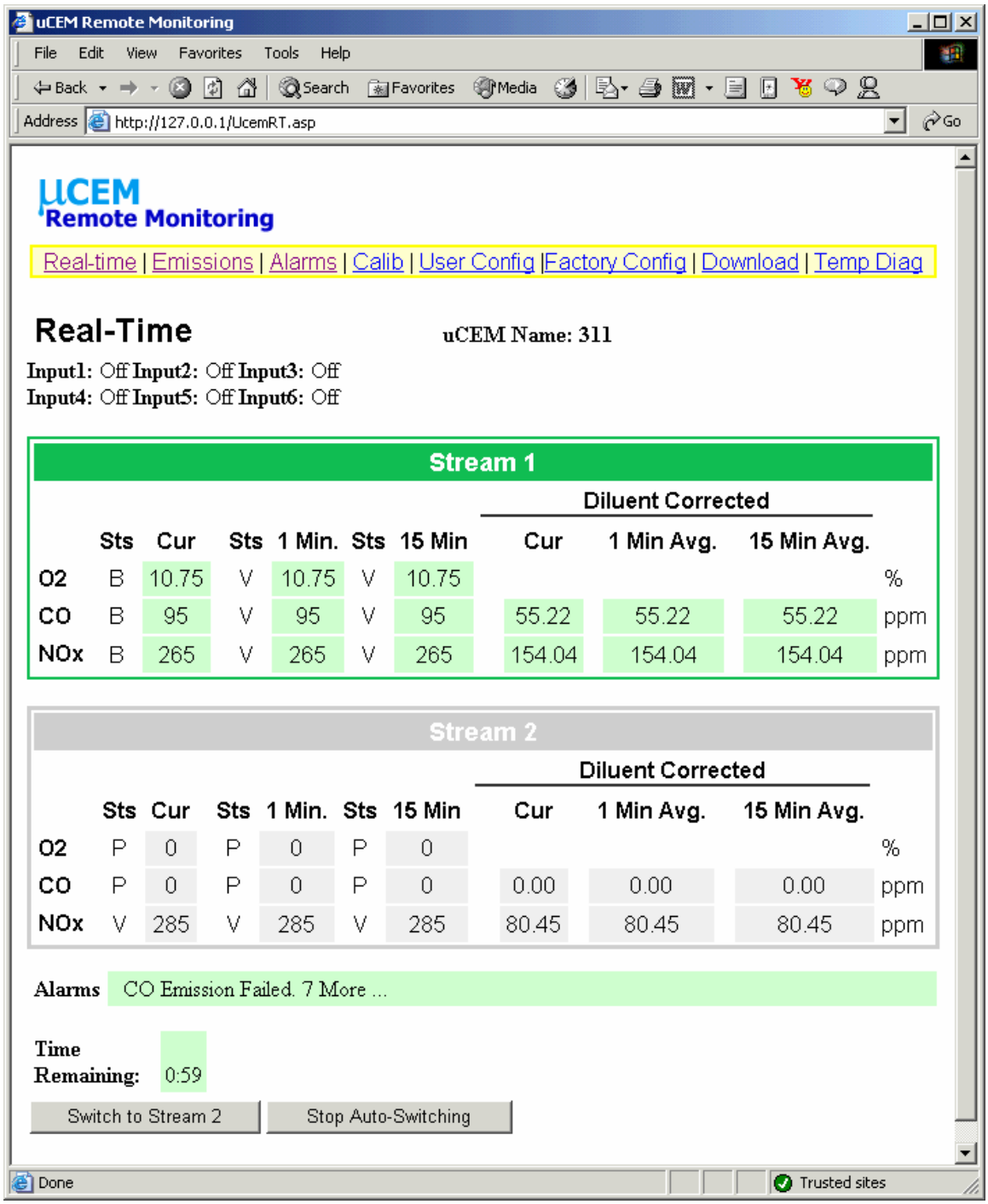

uCEM Remote Monitoring
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://127.0.0.1/UcemRT.asp
Go
µCEM
Remote Monitoring
Real-time | Emissions | Alarms | Calib | User Config | Factory Config | Download | Temp Diag
Real-Time
uCEM Name: 311
Input1: Off Input2: Off Input3: Off
Input4: Off Input5: Off Input6: Off
Stream 1
Diluent Corrected
Sts Cur Sts 1 Min. Sts 15 Min Cur 1 Min Avg. 15 Min Avg.
O2 B 10.75 V 10.75 V 10.75 %
CO B 95 V 95 V 95 55.22 55.22 55.22 ppm
NOx B 265 V 265 V 265 154.04 154.04 154.04 ppm
Stream 2
Diluent Corrected
Sts Cur Sts 1 Min. Sts 15 Min Cur 1 Min Avg. 15 Min Avg.
O2 P 0 P 0 P 0 %
CO P 0 P 0 P 0 0.00 0.00 0.00 ppm
NOx V 285 V 285 V 285 80.45 80.45 80.45 ppm
Alarms CO Emission Failed. 7 More ...
Time Remaining: 0:59
Switch to Stream 2
Stop Auto-Switching
Done
Trusted sites

Figure 4.18 - Real-Time Web Page

4.8.2 Emissions Page

The Emissions Page can be used to view emission history in a tabular web-page format. This page is used as part of the µCEM User interface as well as by a remote user (probably from a desktop computer).

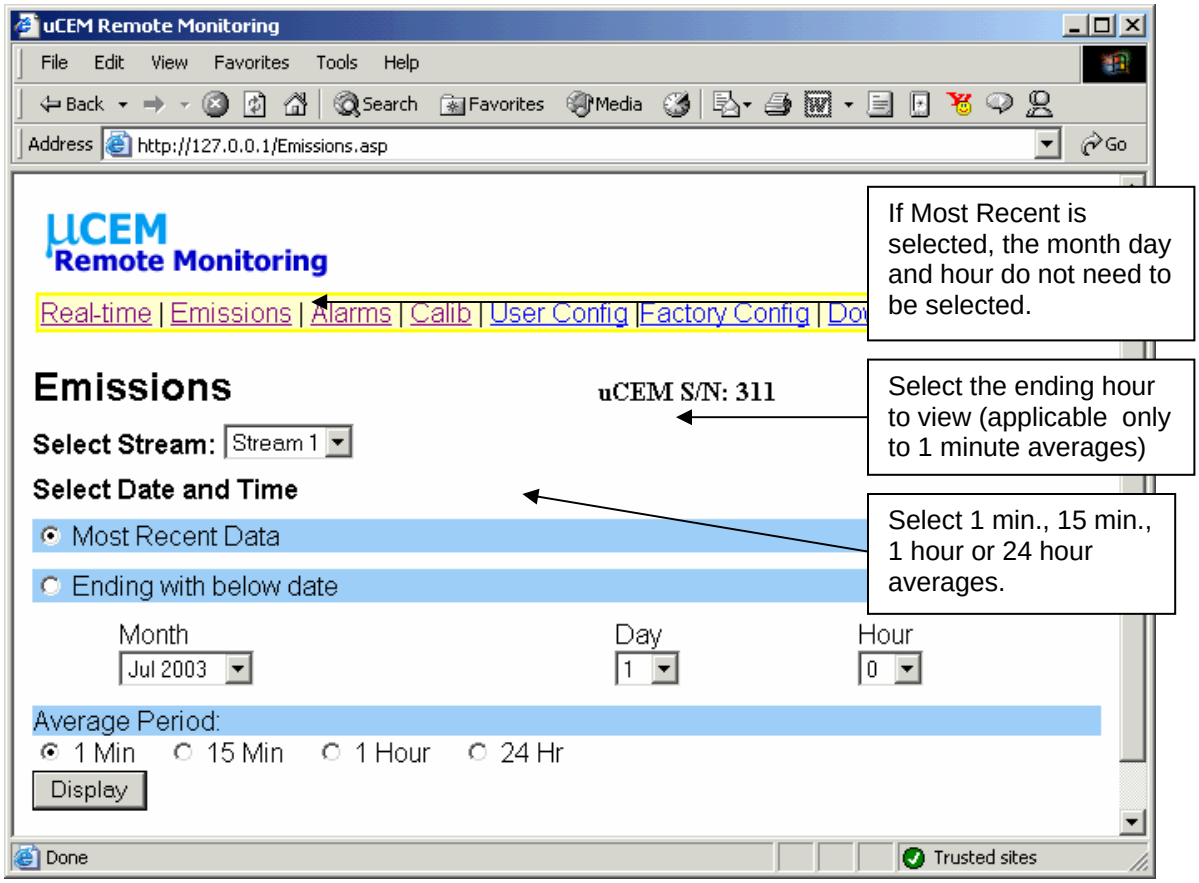
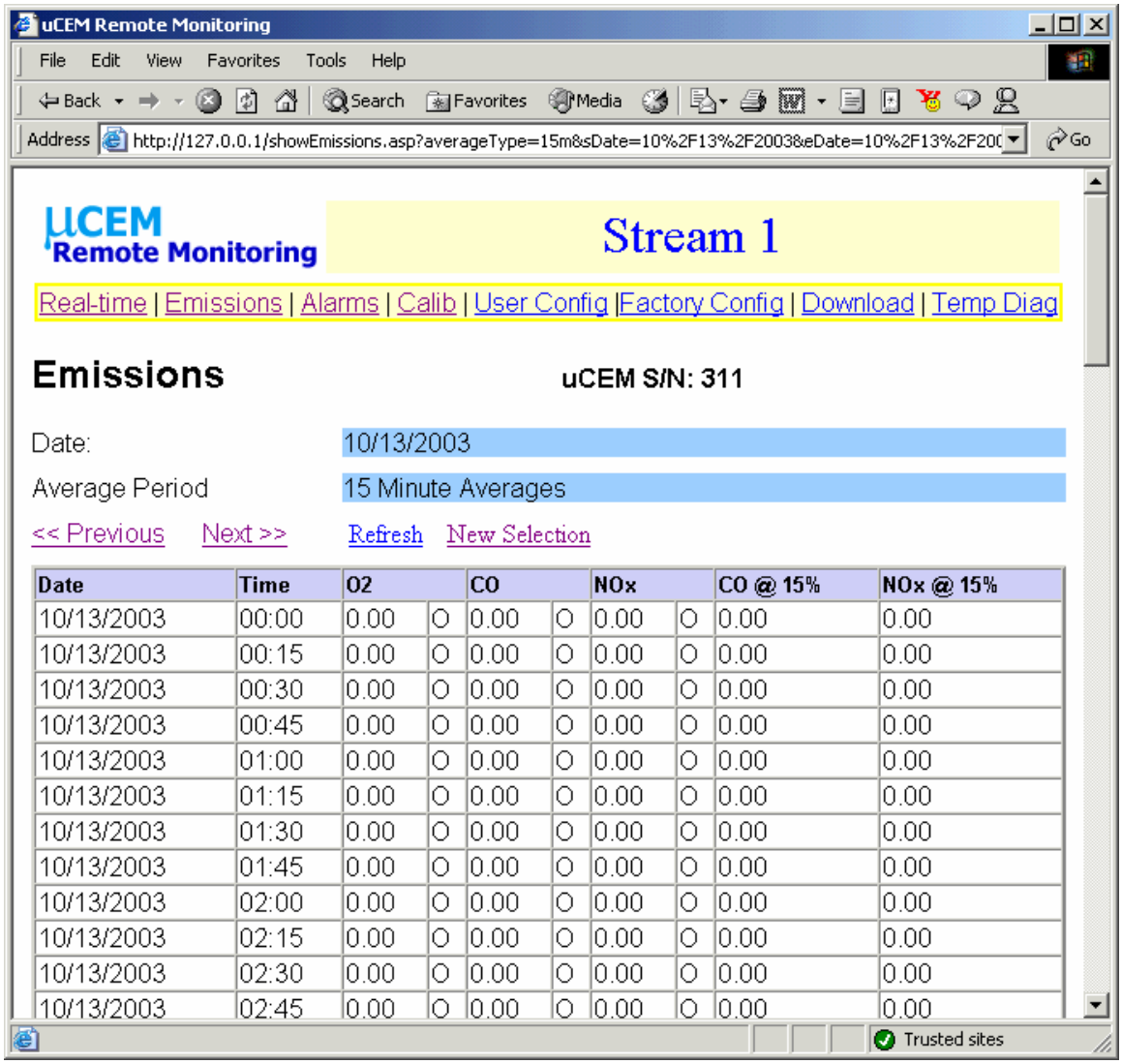

uCEM Remote Monitoring
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://127.0.0.1/Emissions.asp
Go
µCEM
Remote Monitoring
Real-time | Emissions | Alarms | Calib | User Config | Factory Config | Do
Emissions
uCEM S/N: 311
Select Stream: Stream 1
Select Date and Time
Most Recent Data
Ending with below date
Month
Jul 2003
Day
1
Hour
0
Average Period:
1 Min 15 Min 1 Hour 24 Hr
Display
Done
Trusted sites
If Most Recent is selected, the month day and hour do not need to be selected.
Select the ending hour to view (applicable only to 1 minute averages)
Select 1 min., 15 min., 1 hour or 24 hour averages.

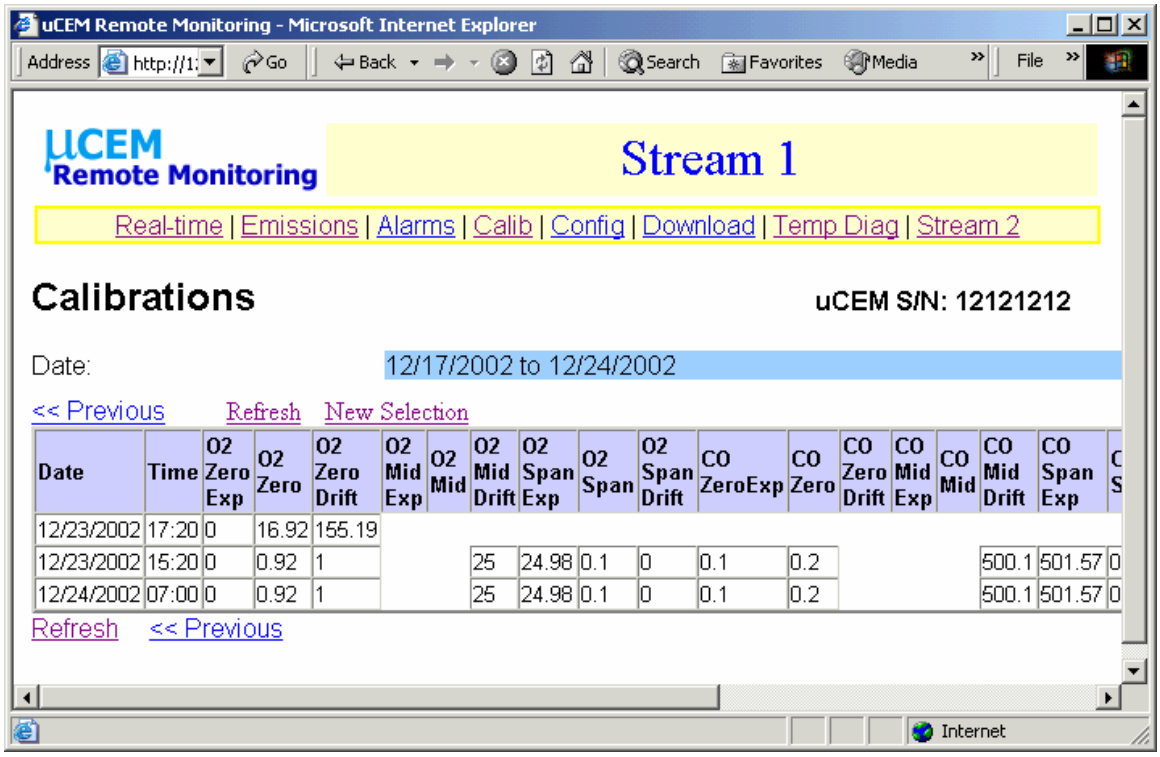
Figure 4.19 – Emissions Selection

The Emission Data-Logs table is displayed (as shown in figure 4.19) after selecting the Date and Average Period and pressing the Display button. If desired a bookmark or shortcut may be made to the page displaying the table. In the future, the same table can be displayed by selecting this bookmark. If Most Recent Data was selected, the book-marked page will always display Most Recent Data. If a specific date was specified, the book-marked page will always display the same date.


uCEM Remote Monitoring
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://127.0.0.1/showEmissions.asp?averageType=15m&sDate=10%2F13%2F2003&eDate=10%2F13%2F200
Go
µCEM Remote Monitoring
Stream 1
Real-time | Emissions | Alarms | Calib | User Config | Factory Config | Download | Temp Diag
Emissions
uCEM S/N: 311
Date: 10/13/2003
Average Period 15 Minute Averages
<< Previous Next >> Refresh New Selection
Trusted sites

Date	Time	O2	CO	NOx	CO @ 15%	NOx @ 15%
10/13/2003	00:00	0.00 O	0.00 O	0.00 O	0.00	0.00
10/13/2003	00:15	0.00 O	0.00 O	0.00 O	0.00	0.00
10/13/2003	00:30	0.00 O	0.00 O	0.00 O	0.00	0.00
10/13/2003	00:45	0.00 O	0.00 O	0.00 O	0.00	0.00
10/13/2003	01:00	0.00 O	0.00 O	0.00 O	0.00	0.00
10/13/2003	01:15	0.00 O	0.00 O	0.00 O	0.00	0.00
10/13/2003	01:30	0.00 O	0.00 O	0.00 O	0.00	0.00
10/13/2003	01:45	0.00 O	0.00 O	0.00 O	0.00	0.00
10/13/2003	02:00	0.00 O	0.00 O	0.00 O	0.00	0.00
10/13/2003	02:15	0.00 O	0.00 O	0.00 O	0.00	0.00
10/13/2003	02:30	0.00 O	0.00 O	0.00 O	0.00	0.00
10/13/2003	02:45	0.00 O	0.00 O	0.00 O	0.00	0.00

Figure 4.20 - Emissions Table



Date	Time	O2 Zero Exp	O2 Zero	O2 Zero Drift	O2 Mid Exp	O2 Mid	O2 Mid Drift	O2 Span Exp	O2 Span	O2 Span Drift	CO ZeroExp	CO Zero	CO Zero Drift	CO Mid Exp	CO Mid	CO Mid Drift	CO Span Exp	C S
12/23/2002	17:20	0	16.92	155.19														
12/23/2002	15:20	0	0.92	1			25	24.98	0.1	0	0.1	0.2				500.1	501.57	0
12/24/2002	07:00	0	0.92	1			25	24.98	0.1	0	0.1	0.2				500.1	501.57	0

Figure 4.21 - Calibration Table

4.8.3 Download Page

The download page of the µCEM allows the selection and download of the three types of Data-Logs. To quickly download recent data, a “Download Most Recent Emissions Data” selection is provided. For more control over the date range, a “Download Emissions by Date Range” selection is available. Once the selection is made, press the Download button to start the HTTP download. The µCEM will create a temporary file that contains the selected data. Due to memory limitations there is a limit to the number of files that can be downloaded simultaneously. If this limit is exceeded, a message will be displayed that reads “The simultaneous download limit has been reached, please try again later”.

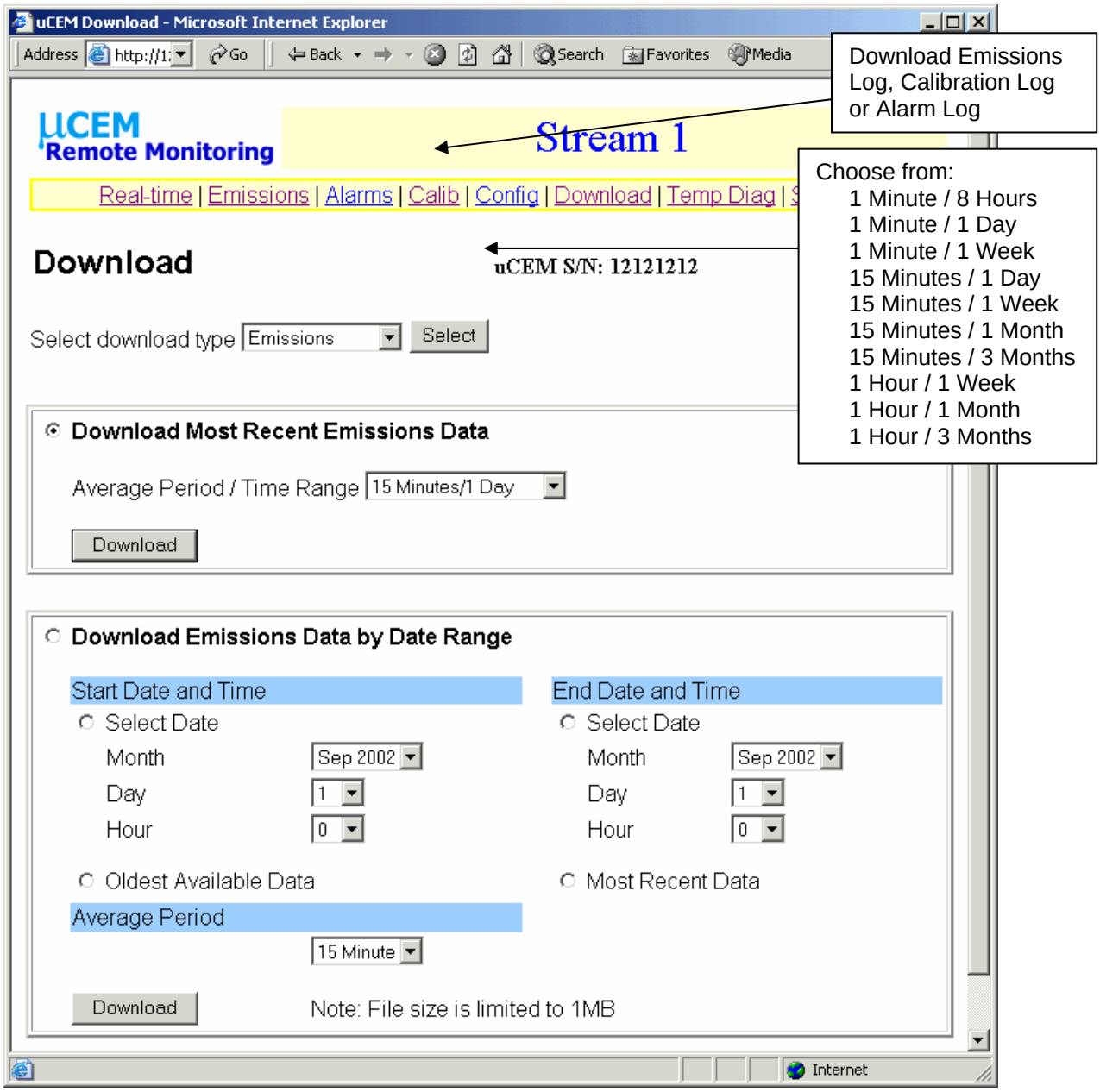


Figure 4.22 - Download Web Page

4.9 Viewing µCEM Data with MS Excel

The µCEM Data may be viewed with MS Excel. CSV comma delineated files can be opened either from the Web browser Session or after the file(s) are saved onto a workstation. The files may then be opened directly with Excel. These files later can be converted and saved in MS Excel native format to enable charting and other secondary analysis functions.

5. Maintenance and Service

CAUTION: QUALIFIED PERSONNEL

This equipment should not be adjusted or repaired by anyone except properly qualified service personnel.

WARNING: PARTS INTEGRITY

Tampering with or unauthorized substitution of components may adversely affect safety of this product. Use only factory-approved components for repair.

WARNING: ELECTRICAL SHOCK HAZARD

Disconnect power to the module(s) prior to replacing components.

The uCEM Analyzer Module requires very little maintenance during normal operation.

5.1 Overview

The uCEM Analyzer Module requires very little maintenance during normal operation.

Occasionally, the detector's reaction chamber and sapphire window may require cleaning, refer to Section 5.7.

White crystal deposits on the windows of the reaction chamber and plugging of capillaries and vent are usually due to sample contaminates such as ammonia reacting with the high ozone levels and NO components. To eliminate the contaminates, the sampling system should be reworked or a preventive maintenance program developed (if dropout is not excessive). Another source of crystalline formation is contaminated air.

Several components may require replacement. These are discussed in the following sections.

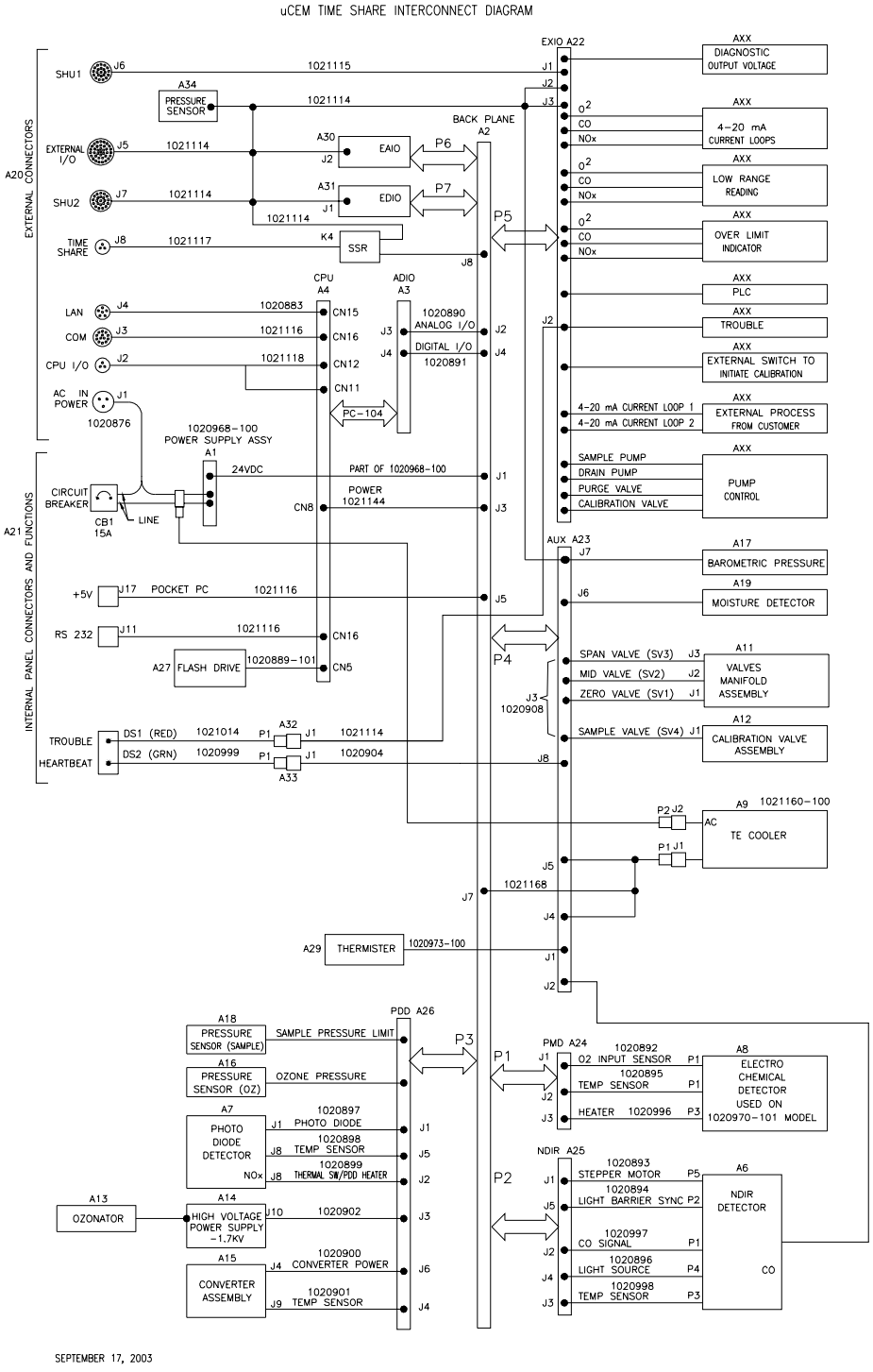


Figure 5-2. uCEM Interconnect Diagram

5.2 Converter

Refer to Figure 5-1, Item 97, and Figure 5-3. To replace the converter or sensor, disconnect the two pneumatic tubes and two electrical connections. Unlace the heater blanket, and remove the converter. Reassemble in reverse order, ensuring that the converter is oriented with the glass cloth at the bottom and the sensor is oriented correctly inside the heater jacket.

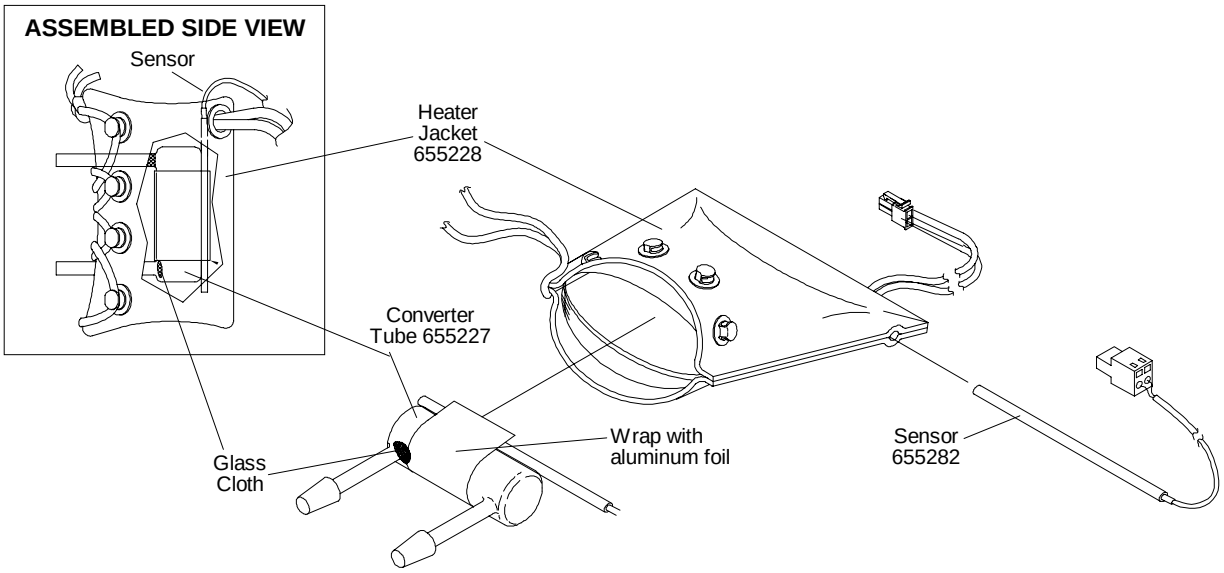


Figure 5-3. Converter Assembly

5.3 Ozonator

Refer to Figure 5-1, item 98.To replace the ozonator, remove the gas fittings, the two large straps and all tie-wraps, and disconnect the one electrical connection. Reassemble in reverse order.

5.4 Personality Modules

There are seven different personality modules. Depending on your unit, you may have three, four five, six, or seven modules installed. These personality modules are installed on a custom backplane. see figure 5-4 for more information.

Tag each cable and its location before disconnecting any wiring. This helps in re-assembly

To remove any on the personality modules. Remove cables from the module to be removed, there are two screws at the bottom of each module. You will have to loosen each screw before you can remove the personality module.

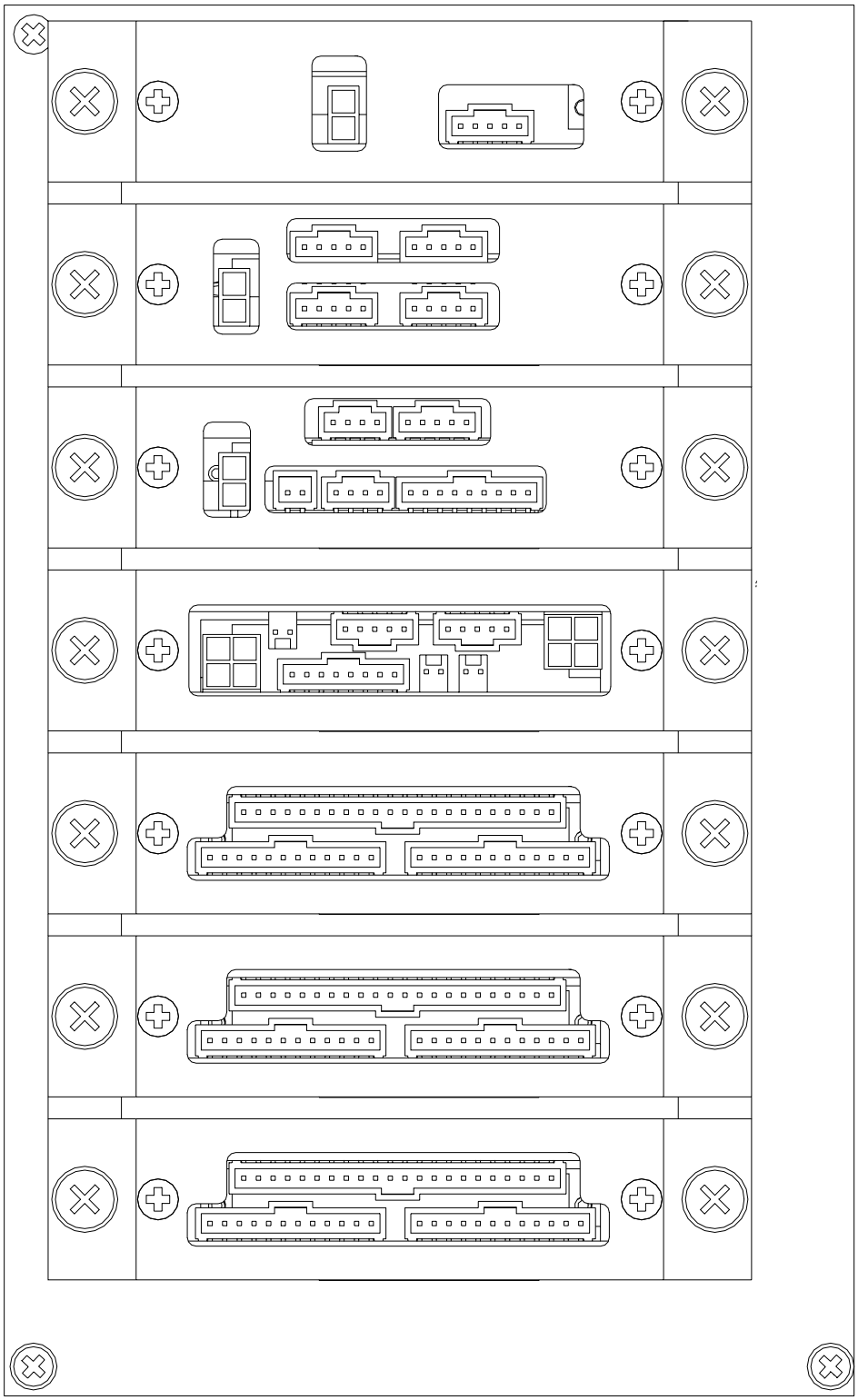


Figure 5-4. Personality Modules and Backplane.

5.5 Detector Assembly

Refer to Figure 5-5 and Figure 5-6.

REACTION CHAMBER REMOVAL:

Disconnect the stainless steel tubing lines at the Gyrolok fittings. Remove the (4) nuts holding the Detector Assembly to the chassis. Disconnect the plug from connector J1 on the Signal Board and remove the assembly from the chassis.

Note: Heatsink Compound. Care should be taken to avoid getting heatsink compound on optical surfaces. If this substance is removed during the disassembly process, a zinc-oxide-filled, silicone grease (e.g., Dow Corning 340 or EG&G Wakefield Engineering's Series 120 Thermal Joint Compound) be reapplied in the re-assembly of this component.

Although the heater and thermostat can be removed to facilitate handling, contact with the white heatsink compound can be minimized by leaving these items in place. Remove the (2) screws holding the top plate of the Detector , and move the plate along the wires and away from the Detector .

Remove the (2) screws holding the tube assembly in place. Hold the tubing with one hand while inverting the Detector Housing with the other, allowing the Reaction Chamber O-ring and window to be removed from below.

REACTION CHAMBER INSTALLATION:

To reinstall, hold the housing in the inverted position while sliding the Reaction Chamber O-ring and window into position and the tubing into the slot in the housing. Hold the Reaction Chamber in place while rotating the housing upright. Replace the hold-down screws.

Note: Component Positioning. The procedure described above is for the purpose of maintaining the relative positions of windows and O-ring to the Reaction Chamber during installation.

Replace the top cap and screws. Reverse the removal procedure to reinstall the Detector Assembly into the Analyzer Module.

PHOTODIODE REMOVAL:

Remove the Detector Assembly as described above. Invert the housing to access the mounting bracket. Remove the (3) screws and shoulder

washers from the bracket. Remove the bracket, insulating disk and bottom plate as a unit to minimize the spread of the heatsink compound.

Remove the (2) screws holding the lower section of the Detector Housing, then slide the section along the cable and remove.

Remove the (2) screws holding the socket, thermistor and photodiode in place, being careful not to lose the washers that are used as shims.

Grasp the socket and photodiode base while slowly rotating to separate the photodiode from the housing. Some friction will be felt as an O-ring is used around the photodiode as a seal.

PHOTODIODE INSTALLATION:

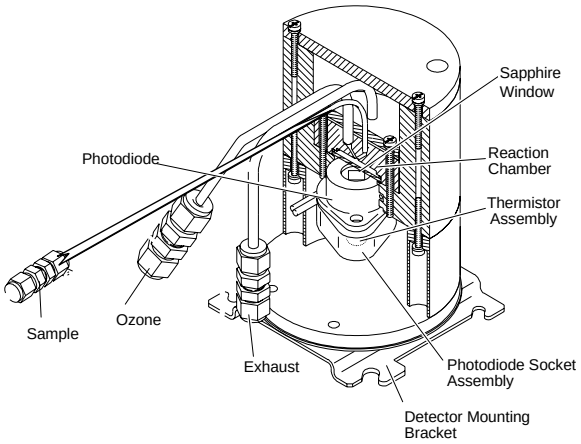
To replace the photodiode, carefully remove the diode from the green socket, and replace with a new one. Before mounting the new diode, the top cap of the enclosure should be temporarily removed and the (2) screws holding the Reaction Chamber loosened about two turns. This allows air which is trapped between the O-ring seals to escape when the diode is inserted. It also maintains the position of the O-ring and window in the upper compartment.

The new photodiode should be slowly inserted into the housing while gradually rotating the body. This allows the O-ring to properly seat. Continue replacing screws, washers, thermistors, etc., with the thicker shim (washer) on the opposite side of the socket from the thermistor.

Replace the lower section of the housing, then the bottom cover, insulator and bracket with the shoulder washers and screws.

Re-tighten the screws in the Reaction Chamber (upper section). Replace the top cap and its screws.

To reinstall in the Analyzer Module, reverse the procedure for removal as indicated above.



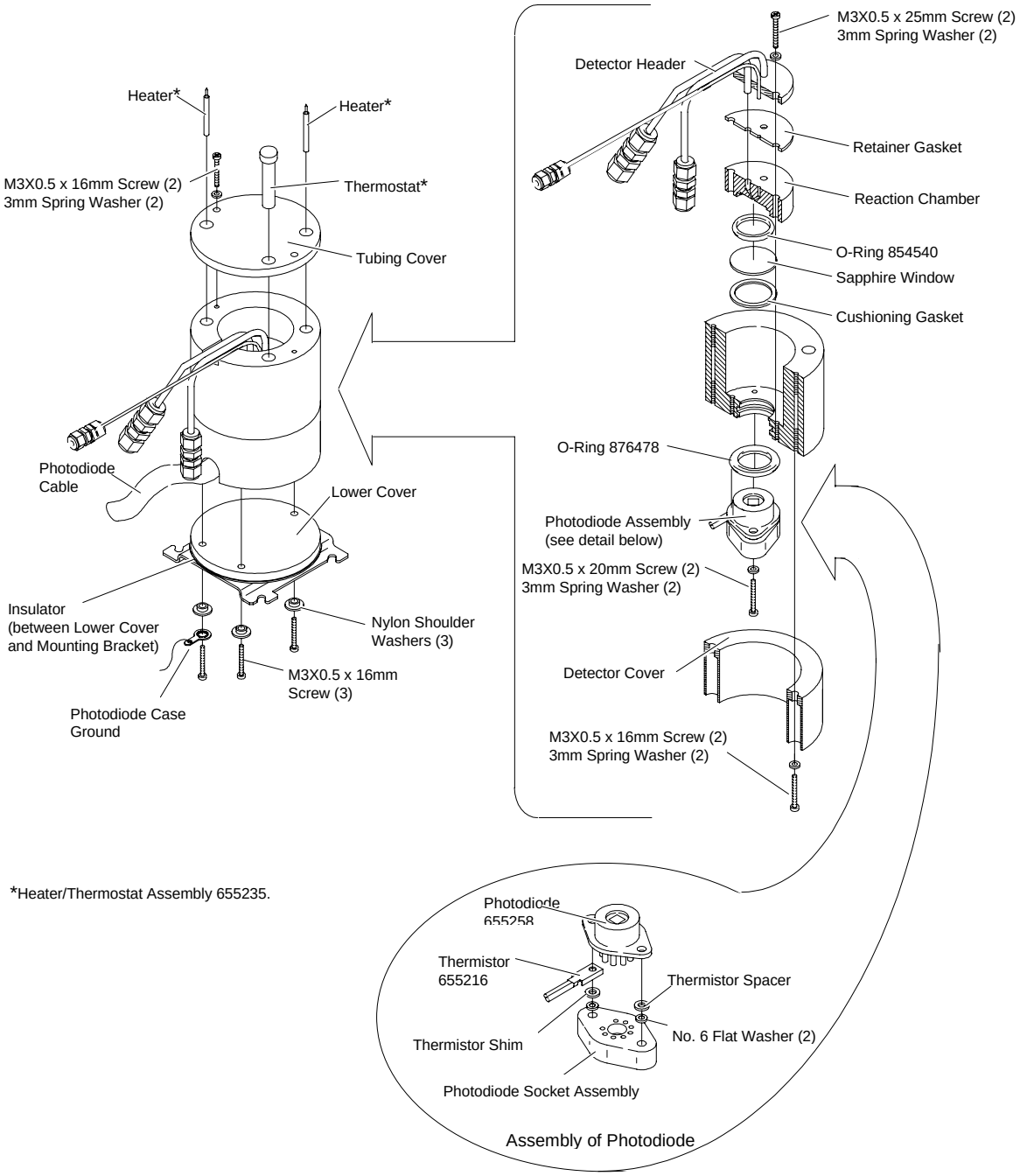


Figure 5-6. Detector Assembly

5.6 Central Processing Unit

The CPU is an Embedded Pentium-type AT Computer in 5.75” x 8” form factor. The peripherals integrated on board are: SVGA, 4 serial ports and one parallel port, Fast Ethernet ctrl., IDE, Keyboard, Mouse, 2 USB. The module is built around the Intel Tillamook processor and is equipped with 64MB SDRAM. The module also integrates one socket for SSD that performs like an HDD unit and can be used to store the operating system, the user’s programs and the data files. Other peripherals available on board are the Floppy disk controller, and the parallel port. The CPU is depicted in Figure 5-7.

Figure 5-7. CPU

5.6.1.1 Features

Architecture:	PC/AT Compatible
Dimensions:	5.75” x 8”
Processor:	Intel Tillamook processor - 266MHz
Memory:	64 MB SDRAM
Ram/Rom disk:	1 x 32 pin socket (max. 288MB)
Operating System:	WinNT
BIOS:	Standard with embedded extensions
Interfaces:	IDE ctrl Floppy ctrl SVGA-CRT 10/100 Mbps Fast Ethernet

	2 USB ports 4 RS232 serial ports (one can be 485) Parallel port (bi-directional EPP-ECP) Keyboard PS/2 Mouse PS/2
Bus:	AT bus according to PC/104 spec.
Power Supply:	AT/ATX
Connectors:	COM1-4, SVGA, USB 1 and 2, PS/2 Mouse/Keyboard, ATX Power, Parallel, IDE, Floppy, and Fast Ethernet

5.6.1.2 EMBEDDED ENHANCED BIOS:

- Award, 256KB Flash Bios.The Bios is immediately activated when you first turn on the system. The Bios reads system configuratio information in CMOS RAM and begins the process of checking out the system.

5.6.2 Analog/Digital I/O Board

The Analog/Digital IO (ADIO) Board is an off-the-shelf, complete data acquisition system in a compact PC/104 packaging. The analog section contains 32 input channels, multiplexed A/D converter with 16 bit resolution and 10uS conversion time. Input ranges are +/-5v or +/- 10V. It also includes on-board DMA support. The analog output section includes two 12 bit D/A converters. Both sections features simplified calibration using on board programmable digital potentiometer. The digital I/O section provides 24 digital I/O lines, which feature high current TTL drivers. The board requires only +5V from the system power supply and generates its own +/-15V analog supplies on board. The board operates over the Extended Temperatures range of -25 to +85C. Figure 3 depicts the ADIO board and Figure 5-9 depicts the ADIO block diagram.

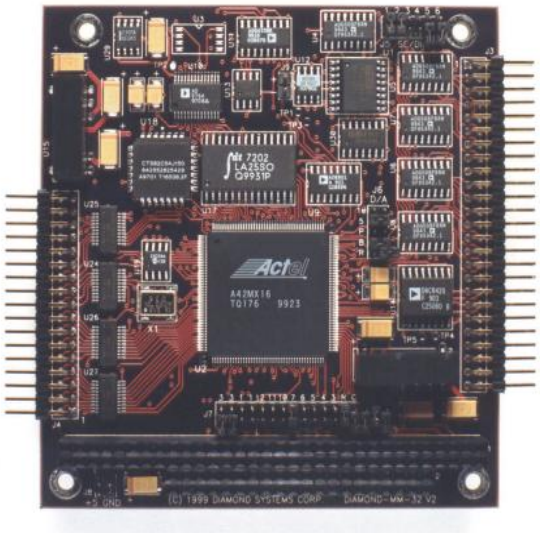


Figure 3-8. ADIO Board

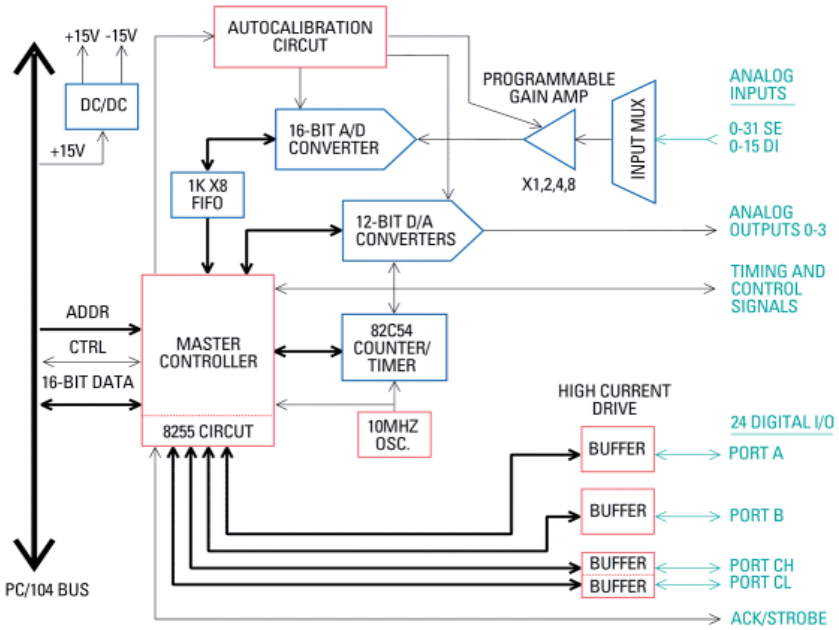


Figure 5-9. ADIO Block Diagram

5.6.2.1 Automatic Calibration

The ADIO board features automatic calibration of both analog inputs and outputs for enhanced accuracy and reliability. The potentiometers, which are subject to tampering and vibration, have been eliminated. Instead, all A/D calibration adjustments are performed using an octal 8-bit DAC. The DAC values are stored in an EEPROM and are recalled automatically on power up. The board includes three precision voltage references for negative full scale, zero, and positive full-scale. A calibration utility program provided with the board allows you to recalibrate the board anytime, in both unipolar and bipolar modes, and store the new settings in EEPROM. Autocalibration applies to the 4 D/A channels as well. The full-scale D/A range is selected with a jumper block. The analog outputs are fed back to the A/D converter so they can be calibrated without user intervention. Again, calibration settings are stored in EEPROM and automatically recalled on power-up.

5.6.2.2 Analog Inputs

The ADIO board provides split configuration capability, with more total input channels than any other PC/104 analog I/O board. The board can be user-configured in any of three ways:

Channels	Format
32	32 single-ended
24	8 differential, 16 single-ended
16	16 differential

5.6.2.3 Programmable Input Ranges

A programmable gain amplifier, programmable unipolar/bipolar range, and programmable 5V/10V full-scale range combine to give the ADIO board a total of 10 different possible analog input ranges. All range settings are controlled in software for maximum flexibility.

Mode	Full-Scale	Gain	Input Range	Resolution
Unipolar	10V	1	0-10V	0.153mV
Unipolar	5V	1	0-5V	0.076mV
Unipolar	5V	2	0-2.5V	0.038mV
Unipolar	5V	4	0-1.25V	0.019mV
Unipolar	5V	8	0-0.625V	0.0096mV
Bipolar	10V	1	±10V	0.305mV
Bipolar	5V	1	±5V	0.153mV
Bipolar	5V	2	±2.5V	0.076mV
Bipolar	5V	4	±1.25V	0.038mV
Bipolar	5V	8	±0.625V	0.019mV

5.6.2.4 Enhanced Trigger and Sampling Control Signals

The ADIO board has an extra A/D trigger and sample control signals in the design. Seven auxiliary digital I/O lines on the analog I/O connector provide a sample/hold output signal, A/D trigger in and out lines (to enable synchronization of multiple boards) and external A/D clocking.

5.6.2.5 Analog Outputs

The ADIO board contains 4 12-bit analog outputs with autocalibration capability. Up to 5mA of output current per channel can be drawn from all channels simultaneously. Both unipolar and bipolar output ranges are supported with jumper configuration. And on power up, all outputs are reset to 0V automatically.

Mode	Full-Scale	Output Range	Resolution
Unipolar	10V	0-10V	2.44mV
Unipolar	5V	0-5V	1.22mV
Bipolar	10V	±10V	4.88mV
Bipolar	5V	±5V	2.44mV

5.6.2.6 FIFO and 16-Bit Bus Interface

An on-board 1024-byte FIFO enables the ADIO board to work with Windows 95 and NT by dramatically reducing the interrupt overhead. Each interrupt transfers 256 2-byte samples, or half the buffer, so the interrupt rate is 1/256 the sample rate. FIFO operation

can be disabled at slow sample rates, so there is no lag time between sampling and data availability. The 16-bit interface further reduces software overhead by enabling all 16 A/D bits to be read in a single instruction, instead of requiring 2 8-bit read operations. The net result of this streamlined design is that the ADIO board supports gap-free A/D sampling at rates up to 200,000 samples per second, twice as fast as our previous boards.

5.6.2.7 Specifications

Analog Inputs	
Number of inputs	32 single-ended, 16 differential, or 16 SE + 8 DI; user selectable
A/D resolution	16 bits (1/65,536 of full scale)
Bipolar ranges	±10V, ±5V, ±2.5V, ±1.25V, ±0.625V
Unipolar ranges	0-10V, 0-5V, 0-2.5V, 0-1.25V, 0-.625V,
Input bias current	100pA max
Overvoltage protection	±35V on any analog input without damage
Nonlinearity	±3LSB, no missing codes
Conversion rate	200,000 samples/sec.max
On-board FIFO	1K x 8(512 16-bit samples)
Calibration	Automatic;values stored in EEPROM
Analog Outputs	
Number of outputs	4
D/A resolution	12 bits (1/4096 of full scale)
Output ranges	±5, ±10, 0-5, 0-10
Output current	±5mA max per channel
Settling time	6µS max to 0.01%
Relative accuracy	±1 LSB
Nonlinearity	±1 LSB, monotonic
Reset	All channels reset to OV
Calibration	Automatic; values stored in EEPROM
Digital I/O	
Main I/O	24 programmable I/O
Input current	±1µA max
Output current	
Logic 0	64mA max per line
Logic 1	-15mA max per line
Auxilary I/O	4 inputs, 4 outputs, optional use as

	trigger/control lines
Counter/Timers	
A/D Pacer clock	32-bit down counter (2 82C54 counters cascaded)
Clock source	10MHz on-board clock or external signal
General purpose	16-bit down counter (1 82C54 counter)
General	
Power supply	+5VD±10%@200mA typ
Operating temperature	-25 to +85ƒC
Weight	3.4oz/96g

5.6.3 PCMCIA Adapter

The PCMCIA adapter supports Type I, II and III PCMCIA cards. The board is in full compliance with Microsoft FFS-II, PCMCIA V.2 and JEIDA 4.1 specifications. The PCMCIA socket accepts The following PCMCIA cards:

Type I	Memory, Flash/SRAM/ROM
Type II	Fax, Modem, LAN, Wireless LAN, and SCSI
Type III	ATA mass storage

Figure 5-10. depicts the PCMCIA interface board.

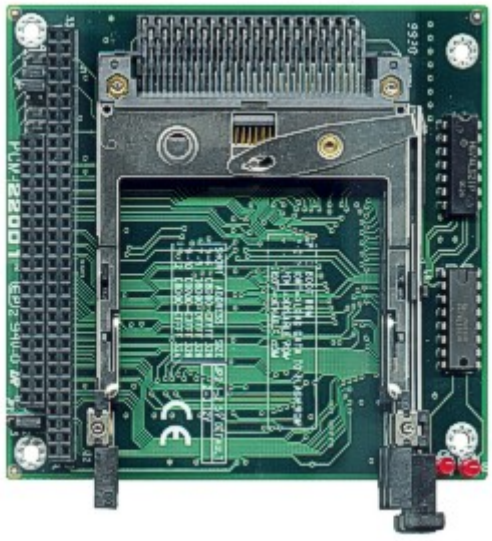


Figure 5-10. PCMCIA Interface

5.6.3.1 Features

Dimensions: compliant with the PC/104 standard
- Compatible with AT PC/104 CPU modules

Functions on board:
2 PCMCIA slots
Optional remote socket

PCMCIA features
- Supports PCMCIA V.1.0 and V.2.0
- Supports PCMCIA types I, II and III
- Supports both I/O and Memory Card
- Supports Hot insertion

Operating Systems
- Dos and Windows and any other RTOS that supports PCMCIA.

Connectors
- J1 : PCMCIA 2 slots connector
- J3: PC/104 8 bit connector (XT compatible)
- J4 : PC/104 16 bit extension (AT extension compatible).

5.6.3.2 SOFTWARE FEATURES:

- Complete set of device drivers complying with PCMCIA V2.1 /JEIDA V4.1, running under MS-DOS or MS-WINDOWS:
i) PCMCIA socket & card services drivers
ii) Flash File System
- Software mappable memory windows and one I/O window
- Jumperless interrupt steering from PC Card to system.

5.6.4 Modem

The PC/104 Modular Modem™ is a self-contained modem module that provides the flexibility to include modem functionality into embedded system, with minimal engineering resources. The PC/104 Modular Modem™ is full featured including high-speed data and fax transmission. The PC/104 Modular Modems support both dial-up and 2-wire leased-line. Figure 5-11 depicts the Modem.

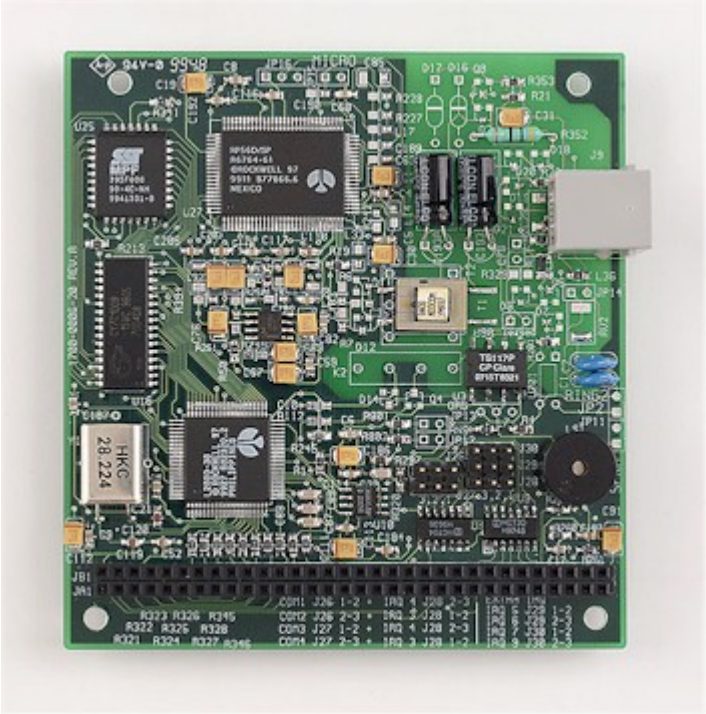


Figure 5-11. Modem

5.6.4.1 Features

V.90, 56 kbps data (560PC/104)
V.34, 33.6 kbps data (336PC/104)
14.4 kbps fax
Voice playback and record
DTMF decode
-40°C to 85°C operation
3.775" x 3.550" x 0.568" (with modular phone jack)
3.775" x 3.550" x 0.435" (without modular phone jack)
8 bit PC/104 bus type
V.42 and MNP 2-4 error correction
V.42bis, and MNP-5 data compression
FCC Part 68 registered
FCC Part 15 compliant
2 wire leased-line and dial up support
Industry Canada CS-03 certified

5.6.5 Flash Drive

Figure 5-12. 256MB Flash Drive.

5.6.5.1 Specifications

Start-up time

System Performance
*Notes 1 & 2

Start-up Time

Sleep to Write	2.5 msec max.
Sleetp To Read	2.5 msec max.
Reset to Ready	50 msec typical 400 msec max.
Data Transfer Rate to/from host	16.0 MB/sec burst
Active to Sleep Delay	Programmable
Controller Overhead Command to DRQ	<1.25 msec

Power Requirements
*Note 1

DC Input Voltage

Commercial	3.3 V ± 5%, 5 V ± 10%
Industrial	3.3 V ± 5%, 5 V ± 5%

Power Dissipation (Notes 3 & 4)

	@3.3 V	@5.0 V
Sleep	200 µA	500 µA
Read	35 mA RMS	50 mA RMS

Write	35 mA RMS	50 mA RMS

Environmental Specifications

Temperature:

Operating Commerical	0°C to 60°C
Operating Industrial	-40°C to 85°C
Non-Operating Commerical	-25°C to 85°C
Non-Operating Industrial	-50°C to 100°C

Humidity:

Operating	8% to 95%, non-condensing
Non-Operating	8% to 95%, non-condensing
Acoustic Noise	0dB

Vibration:

Operating	15 G peak to peak max.
Non-Operating	15 G peak to peak max.

Shock:

Operating	1,000 G max.
Non-Operating	1,000 G max.

Altitude (relative to sea level)

Operating/Non-Operating	80,000 feet max.

System Reliability and Maintenance

MTBF (Mean Time Between Failures)	>1,000,000 hours
Preventive Maintenance	None
Data Reliability	<1 non-recoverable error in $10^{(14)}$ bits read

Physical Specifications

Length	100.2mm ± 0.51mm
Width	69.85mm ± 0.51mm
Thickness (Body)	9.6mm ± 5.0mm
Thickness (Removable Edge)	N/A
Weight	160 g. max

Note 1: All values quoted are typical at ambient temperature and nominal supply voltage unless otherwise stated.
Note 2: All performance timing assumes the controller is in the default (i.e., fastest) mode.
Note 3: Sleep mode currently is specified under the condition that all card inputs are static CMOS levels and in a "Not Busy" operating state.
Note 4: The currents specified show the bounds of programmability of the product.

5.6.6 Pocket PC

The Pocket PC acts as an Graphic User Interface to the μCEM unit. Figure 5-13 depicts the Pocket PC.

Figure 5-13. Pocket PC

Following are the Pocket PC specifications:

Processor	206MHz StrongArm processor
Memory	32MB RAM, 32MB ROM
Display	240 x 320 pixels LCD, TFT color CSTN, backlit
User Interface	Pen-and-touch interface (stylus included) Handwriting recognition software On-screen keyboard 4 user-configurable quick launch screen icons 2 quick keys (Record and Scroll/Action) Notification LED
Power	Built-in Lithium-Ion rechargeable battery 8 hours of battery life 1 Worldwide auto-voltage AC adapter
Input/Output	IrDA infrared port RS232 serial port USB port CompactFlash Type I card slot AC input jack Stereo earphone jack
Sound	Audio speaker and microphone Built-in voice recorder Digital audio player compatible
Other Standard	USB cradle

Features	Serial cable Earphones Removable metal cover Password protected and DMI compatible
Physical Specifications	5.2 × 3.1 × 0.6 in (13 × 7.8 × 1.6 cm) 9.1 oz (260 g) with battery
Operating Requirements	Operating temperature: 32–104° F (0–40° C) Storage temperature: 32–140° F (0–60° C) Humidity: 90% relative humidity at 104° F (40° C)

5.6.7 Wireless LAN Adapter

Wireless LAN adapter is an option to allow the user to remove the Pocket PC from the enclosure and to operate the μCEM from a distance up to 1000 feet. Figure 5-14 depicts the wireless LAN adapter.

Figure 5-14. Wireless LAN adapter

Following is a technical description of the wireless LAN adapter.

Data Rate:	11 Mbps send/receive with automatic fallback for extended range
Useful Range:	Up to 1000 feet (300 meters) open field; 300 feet (90 meters) typical indoor installations (intervening metal and thick concrete structures degrade performance and range)
Security:	Supports Wired Equivalent Privacy (WEP) which provides 64-bit and 128-bit data encryption; additional security through the use of a 32-character network system ID
Standard Support:	Interoperable with 2 Mbps IEEE 802.11 Direct Sequence Spread Spectrum (DSSS) and 802.11b (11 and 5.5 Mbps) extension
OS Support:	NDIS drivers included for Windows 95, 98, ME and NT and 2000
Channels:	Supports 11 US/Canada and 13 ETSI selectable, fully-independent channels
Transmit Power:	25mW typical
Radio Frequency:	2.4 to 2.4835 GHz
Power Requirement:	PC Card: 5 VDC @ 217 mA average with 338 mA maximum on transmit; 215 mA continuous receive, 17 mA standby PCI: 5VDC @ 247 mA average with 368 mA maximum on transmit; 245 mA continuous receive, 47 mA standby
Status lights:	1 (Reports: Link, Power)
Regulatory Approval:	US - FCC part 15B and 15C, IC RSS-210

	ETSI - FCC part 15B, CE, ETS 300 328, ETS 300 826, C-Tick (Australia)
Physical	PC Card: PCMCIA Type II PC Card
Specification:	PCI: 32-bit, 5V Key, Full Plug-N-Play
Antenna(s):	Integrated: Printed dual diversity
	External: 2.2dBi dipole; additional options for specific installation needs

5.6.8 500 Watts Power Supply

The 500 Watts power supply combine high performance midrange power with high power density (4.4 watts/in ^{3}),active Power Factor Correction (PFC) and high reliability to meet the requirements of commercial and industrial systems. Providing tightly regulated DC power, the power supply delivers full output performance with only 300 Linear Feet per Minute (LFM) forced air-cooling by utilizing a factory installed fan. Other features include remote sense, power fail, logic level inhibit, DC power good. Main channel current sharing is provided for redundant applications. The power supply is approved to the latest international regulatory standards, and displays the CE Mark.

Figure 5-15. 500 Watts Power Supply

5.6.8.1 FEATURES

- Power Factor Correction (PFC) Meets EN61000-3-2
- Fully Regulated Outputs
- Remote Sense
- Current Share, Power Fail, and Power Good Signals
- Overtemperature, Overvoltage, and Overcurrent Protected
- Available with Metric or SAE Mountings
- Input Transient & ESD Compliance to EN61000-4-2/-3/-4/-5

• Fan Output Voltage and Optional Fan
• Optional Isolation Diodes for Parallel or Redundant Operation

5.7 Replacement Parts

WARNING: PARTS INTEGRITY

Tampering with or unauthorized substitution of components may adversely affect the safety of this product. Use only factory approved components for repair.

5.7.1 Replacement Part list

The following is a list of replacement parts for the uCEM analyzer. For other parts or service, contact the factory as indicated in session 6.

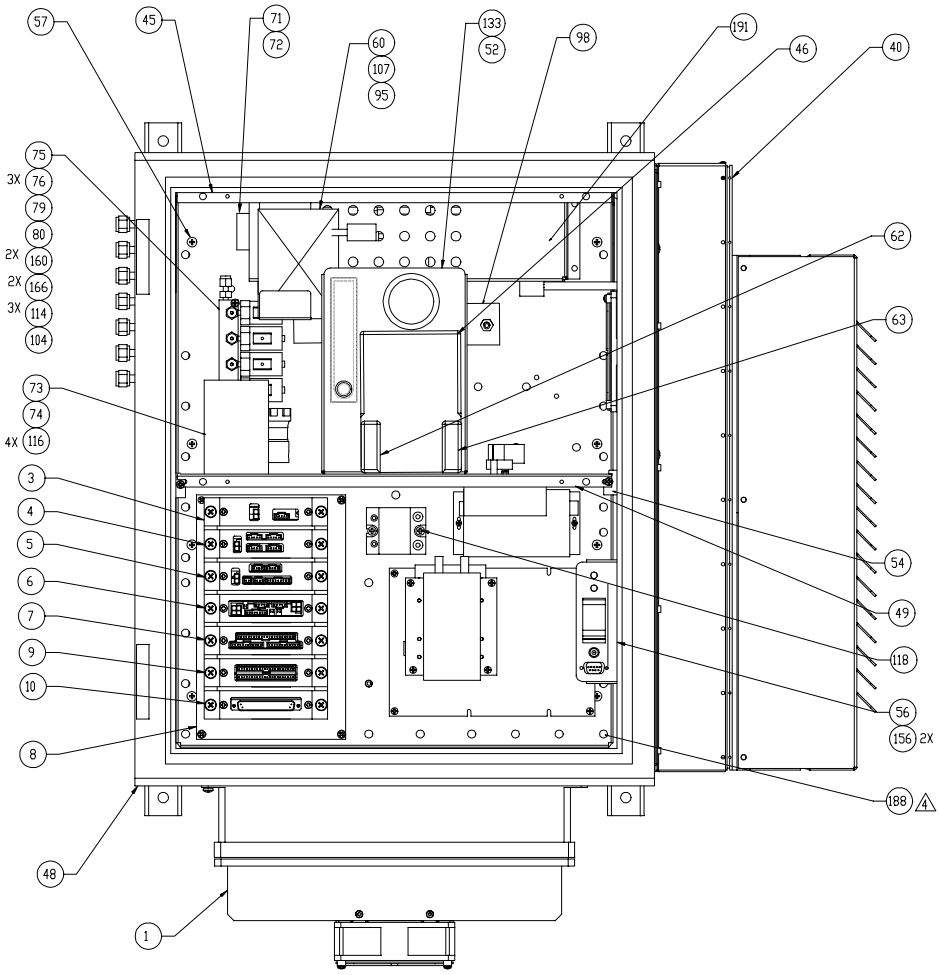


Figure 5-4. uCEM Analyzer with door open – Front View

PARTS LIST

Item	Vendor	Mfg. Part Number	Description
1	CSTS	1020968-100	Assy, Power Supply
2	CSTS	1020113-102	Flow Diagram
3	CSTS	1020839-101	Assy, PMD Module
4	CSTS	1020840-100	Assy, NDIR Module
5	CSTS	1020841-102	Assy, PDD Module
6	CSTS	1020842-102	Assy, AUX Module
7	CSTS	1020843-101	Assy, EXIO Module
8	CSTS	1021109-101	Assy, Backplane, Electronic Modules, T/S
9	CSTS	1021146-100	Assy, EAIO Module
10	CSTS	1021146-100	Assy, EDIO Module
11	CSTS	1021108-100	Assy, MLT-IR UV Module
12	CSTS	1021114-101	Cable Assy, EXT I/O interface, Internal
13	CSTS	1020876-101	Assy, Cable, AC Power Distribution
14	CSTS	1021099-100	Assy, Cable, +24V Power to Bckplane, SO2
15	CSTS	1020877-101	Assy, Cable, +24V Power to Backplane
16	CSTS	1020878-100	Assy, Cable, SBC Power from Backplane
17	CSTS	1020883-100	Assy, Cable, LAN
18			
19	CSTS	1020999-100	Assy, Cable, Heartbeat LED
20	CSTS	1021014-100	Assy, Cable, Trouble LED
21	CSTS	1021116-100	Assy, Cable, Serial, RS232/485, Intenal
22			
23	CSTS	1020889-101	Cable Assy, IDE Drive
24	CSTS	1020890-100	Cable Assy, Analog I/O, Ribbon
25	CSTS	1020891-100	Cable Assy, Digital I/O, Ribbon
26	CSTS	1020892-100	Cable Assy, Detector Signal, PMD
27	CSTS	1020893-100	Cable Assy, NDIR Stepping Motor
28	CSTS	1020894-100	Cable Assy, NDIR Light Barrier
29	CSTS	1020895-100	Cable Assy, Thermister, PMD
30	CSTS	1020896-100	Cable Assy, NDIR Light Source
31	CSTS	1020897-100	Cable Assy, PDD Petier
32	CSTS	1020898-100	Cable Assy, PDD, Heater Temperature
33	CSTS	1020899-100	Cable Assy, PDD, Heater Power
34	CSTS	1020900-100	Cable Assy, Converter Power
35	CSTS	1020901-100	Cable Assy, Converter Temperature
36	CSTS	1020902-100	Cable Assy, Ozonator Power
37	CSTS	1021168-100	Cable Assy, TE Cooler Power/Control
38	CSTS	1020904-100	Cable Assy, System Heartbeat Indicator
39	CSTS	1021090-100	Cable Assy, ELECTRO/CHEMICAL, THERMISTOR
40	CSTS	1021160-100	Assy, TE Cooler, 14 Modules
41	CSTS	1020907-100	Cable Assy, Zone Temperature, Internal, External

42	CSTS	1020908-100	Cable Assy, Gas Valve Control
43			
44	CSTS	1021115-100	Cable Assy, SHU#1 I/O
45	CSTS	31503	CHASSIS, Top, INTERNAL, uCEM
46	CSTS	31334	INSULATOR, POCKET PC
47	CSTS	31338	BRACKET, MOUNTING, REGULATOR
48	CSTS	31530	ENCLOSURE, MODIFIED, FIBERGLASS
49	CSTS	31528	SHELF, OVEN, SLIDING
50	CSTS	31529	COVER, INTERNAL, uCEM
51	CSTS	31531	OVERLAY, CONNECTOR PANEL
52	CSTS	31353	BKT, FLOWMETER/GAUGE
53	CSTS	31355	GUIDE, SHELF, LEFT
54	CSTS	31356	GUIDE, SHELF, RIGHT
55			
56	CSTS	31367	PANEL, BREAKER/RS232, Ucem
57	CSTS	31502	CHASSIS, REAR, INTERNAL, uCEM
58	CSTS	31532	PLATE, MOUNTING, CONNECTOR, I/O
59	CSTS	31270	PLATE, MOUNTING, BH, FEED THRU
60	CSTS	31281	BRACKET, MOUNTING, CONVERTER
61			
62	CSTS	31283	BRACKET, MTG, POCKET PC, LEFT
63	CSTS	31284	BRACKET, MTG, POCKET PC, RIGHT
64	CSTS	31285	FRAME, GLASS, ENCLOSURE
65	CSTS	31286	GLASS, WINDOW, ENCLOSURE DOOR
66	CSTS	31287	GASKET, WINDOW
67	CSTS	31289	GASKET, CONNECTOR PANEL
68	CSTS	31290	GASKET, GAS PORT PANEL
69	CSTS	31299	PLATE, MOUNTING, 2.5 HARD DRIVE
70	RMT-GMBH	42711801	Cable, Electrical
71	RMT-GMBH	42714157	ElectroChemical Detector
72	RMT-GMBH	42715604	NDIR Detector
73	RMT-GMBH	90003311	Paramagnetic Detector, Insulated
74	RMT-GMBH		Cable, Electrical (Paramagnetic Detector
75	SNAP-TITE	100-900-472-04	Manifold, 4port
76	SNAP-TITE	2W1.3W-5DR-E2.46	2 way Valve
77	SNAP-TITE	3W16W-1NR--V2A6	3 way Valve
78	DWYER INST.	RMA-14SSV	Flowmeter
79		Any MPT-1/8 CRES	1/8 mpt, Plug
80	HOKE/SWAGELOC	2CM2-316/SS-200-1-2	1/8 mpt x 1/8t, Fitting
81	HOKE/SWAGELOC	4LM4-316/SS-400-2-4	1/4mpt x 1/4t 90 deg El
82	HOKE/SWAGELOC	4BU-316/SS-400-61	1/4 x 1/4t Bulkhead Coupling, SS
83	CRAWFORD/SWGLO	B-400-61-2	1/4 x 1/8t Bulkhead Coupling,brass
84	HOKE/SWAGELOC	2TTT-316/SS-200-3	1/8t "Tee"
85	HOKE/SWAGELOC	2CF2/B-200-7-2	1/8t x 1/8fpt Coupling, brass
86	INSOL.SUPPLY	31413	1/8 inch tubing
87	INSOL.SUPPLY	31415	1/4 inch tubing
88	INSOL.SUPPLY	31414	1/8 inch black tubing

89	Westam Rubber	31412	1/4 inch tubing, Viton
90	RMT-GMBH	337489	Desicannt Bulbs
91	Sante Fe Rub. Prod.	632784	1/4glass x 1/8t, Grommet
92	RAI	634398	Capillary, Vent
93	Marshal Town Mfg. Or Marsh Inst. Co.	J2442	Gage, Pressure
94	CSTS	1020973-100	Assy, Cable,Thermistor
95	RAI	655250	Converter
96	SWAGELOC	SS-0RM2	Trim Valve, 1/8 male NPT
97	RAI	657716	Power Supply-Ozonator
98	Te Lite	657719	Ozone Generator
99	RAI	658157	Restrictor, brass
100	RAI	659754	Photo Diode Detector
101	HOKE/SWAGELOC	2TMT2-316/SS-200-3TMT	1/8MPT X 1/8t MALE RUN TEE
102	HOKE/SWAGELOC	2TMT4-316/SS-3-4TMT	1/4MPT X 1/8t MALE RUN TEE
103	HOKE/SWAGELOC	2R4-316/SS-200-R-4	Reducer
104	HOKE/SWAGELOC	2LU-316/SS-200-9	90 deg El (used with PDD)
105	HOKE/SWAGELOC	2CF2-316/SS-200-7-2	1/8FPT X 1/8t
106		ANY1/4" CRES	10-32 Set screw, CRES
107			Spring (Converter)
108	HOKE/SWAGELOC	4BRU2-316/SS-400-61-2	1/4 x 1/8t Bulkhead Coupling, SS
109	HOKE/SWAGELOC	4PC-316/SS-401-PC	Fitting, 1/4 inch connector tube
110	CLIC	CLIC-47	Clamp
111	JACO	70-2KO	1/8t "Tee" Kynar
112	SIEMENS-MOORE or MOORE PROD. CO	12023-47 or BM-12023-47/3VJ	Regulator
113	HOKE	4R2-316	1/8 to 1/4 Adapter Fitting
114	NUMATIC	SF-062-SS	1/8t (barb) x 10-32w/seal Fitting
115	HOKE	4C-316	1/4t CROSS
116		M4 x 0.5 x 16mm	Screw, M4 x 0.5 x 16mm
117			
118	CRYDOM	D1D12	RELAY, POWER, 12 AMPS
119			
120	CSTS	1021118-100	Cable Assy, CPU I/O
121	CSTS	1021121-100	Cable Assy, SSU POWER, External, 6’
122	CSTS	1021122-100	Cable Assy, CPU I/O, External, 6'
123	KAD	M3 X 6mm	Screw, PHP, M3 x 6mm
124	CSTS	1021143-100	DRIVE, FLASH, 256MB, REV. B1.3
125	CSTS	1020996-100	Cable Assy, Heater, PMD
126	CSTS	1020997-100	Cable Assy, Detector Signal, NDIR
127	CSTS	1020998-100	Cable Assy, Thermister, NDIR
128	World Magnetics	9032-904	Pressure Switch, PSF103, Barb conn
129	McMaster-Carr	30345T4	LANYARD, 12 INCH, 304 SS, EYE ENDS
130	COMM CON	HW-PC440NP	NUT, 4-40, NYLON
131	CSTS	31298	SPACER, PC104
132	COMM CON	HW-PC440SP	SCREW, 4-40 X .18, NYLON
133	COMM CON	HW-PC600P	SPACER, PC104, NYLON

134	CSTS	1020976-101	ASSY, CPU, PC104
135	CSTS	1020977-100	ASSY, I/0, PC104
136	CSTS	1021119-100	Cable Assy, EXT I/O Interface, External, 6'
137	CSTS	1021120-100	Cable Assy, SHU Interface, External, 6'
138	CSTS	1020984-100	Cable Assy, AC Power, 110VAC, Ext, 6'
139	CSTS	31354	Clamp, Cable, Fiber Optic
140	CSTS	31376-01	Cover, Connector Opening, .594
141	CSTS	31376-02	Cover, Connector Opening, .719
142	CSTS	31376-03	Cover, Connector Opening, .812
143	CSTS	31376-04	Cover, Connector Opening, .906
144	CSTS	31376-05	Cover, Connector Opening, .969
145	Fastener Spec.	FSSI-8	Plate, Nut, .594
146	Fastener Spec.	FSSI-10	Plate, Nut, .719
147	Fastener Spec.	FSSI-12	Plate, Nut, .812
148	Fastener Spec.	FSSI-14	Plate, Nut, .906
149	Fastener Spec.	FSSI-16	Plate, Nut, .969
150	Amphenol (TTI)	10-101949-08	Gasket, Connector, Shell Size 8
151	Amphenol (TTI)	10-101949-10	Gasket, Connector, Shell Size 10
152	Amphenol (TTI)	10-101949-12	Gasket, Connector, Shell Size 12
153	Amphenol (TTI)	10-101949-14	Gasket, Connector, Shell Size 14
154	Amphenol (TTI)	10-101949-16	Gasket, Connector, Shell Size 16
155	KAD	MS24693-C3B	Screw, FHP, 4-40 X .312, Black
156	KAD	MS24693-C25B	Screw, FHP, 6-32 X .312, Black
157	KAD	MS51957-26	Screw, PHP, 6-32 x .25
158	KAD	MS51957-28	Screw, PHP, 6-32 x .38
159	KAD	MS51957-30	Screw, PHP, 6-32 x .50
160	KAD	MS51957-	Screw, PHP, 6-32 x
161	KAD	MS51957-37	Screw, PHP, 6-32 x 1.75
162	KAD	MS51957-47	Screw, PHP, 8-32 x .75
163	KAD	MS51957-15	Screw, PHP, 4-40 x .38
164	KAD	MS15795-807	Washer, Flat, #8
165	KAD	MS35338-135	Washer, Split Lock, #4
166	KAD	MS35338-136	Washer, Split Lock, #6
167	KAD	MS35338-137	Washer, Split Lock, #8
168	KAD	MS35338-138	Washer, Split Lock, #10
169	KAD	NAS671C8	NUT, HEX, 8-32
170	KAD	MS51957-63	Screw, PHP, 10-32 x .50
171	KAD	MS51957-64	Screw, PHP, 10-32 x .62
172	KAD	MS51957-65	Screw, PHP, 10-32 x .75
173	Fastener Spec.	FSSI-22	Plate, Nut, 1.375
174	KAD	MS24693-C25	Screw, FHP, 6-32 X .312
175	3M	4926	Tape, VHB, Double sided, .015 x 1.0
176			
177	CSTS	31391-5	Insulation, Enclosure
178	CSTS	31391-6	Insulation, Enclosure
179	CSTS	31391-7	Insulation, Enclosure
180	CSTS	31391-8	Insulation, Enclosure

181	CSTS	31391-9	Insulation, Enclosure
182	CSTS	31391-10	Insulation, Enclosure
183	CSTS	31391-11	Insulation, Enclosure
184	CSTS	31391-12	Insulation, Enclosure
185	CSTS	31391-1	Insulation, Enclosure
186	CSTS	31391-4	Insulation, Enclosure
187	RICHCO	BHKL350-4-01	Blind Hole Kurly-Lok, .30-.40 dia bundle
188	RICHCO	BHKL750-4-01	Blind Hole Kurly-Lok, .70-.80 dia bundle
189	CSTS	1020973-102	Cable Assy, CO Detector Thermistor
190			
191	CSTS	31504	Cover, SO2 Detector, Long
192	CSTS	31508	Insulator, Mounting, PS, UV Detector
193	CSTS	31508	Bracket, Mounting, SO2 Detector
194	EAR	G-411-1	Grommet, Damping
195	CLIC	CLIC-43	Clamp, 1IN ID
196	RMT-GMBH	TBD	DETECTOR, SO2
197	E-T-A	3130-F212-P7T1-S120	CIRCUIT BREAKER
198	Amphenol (TTI)	10-202949-22	GASKET, CONNECTOR, SHELL SIZE 22

Table 5-2. Replacement Part List

5.8 System Enclosure

The µCEM is enclosed in a rugged fiberglass enclosure. The enclosure is self contained and has the following approximate weight and dimensions:

Construction: Fiberglass, with environmentally sealed access door
Dimensions: 24” x 20” x 8”
Weight: ~68Lbs

Figure 5.16 Illustrate the systems enclosures with all of the physical components layout.

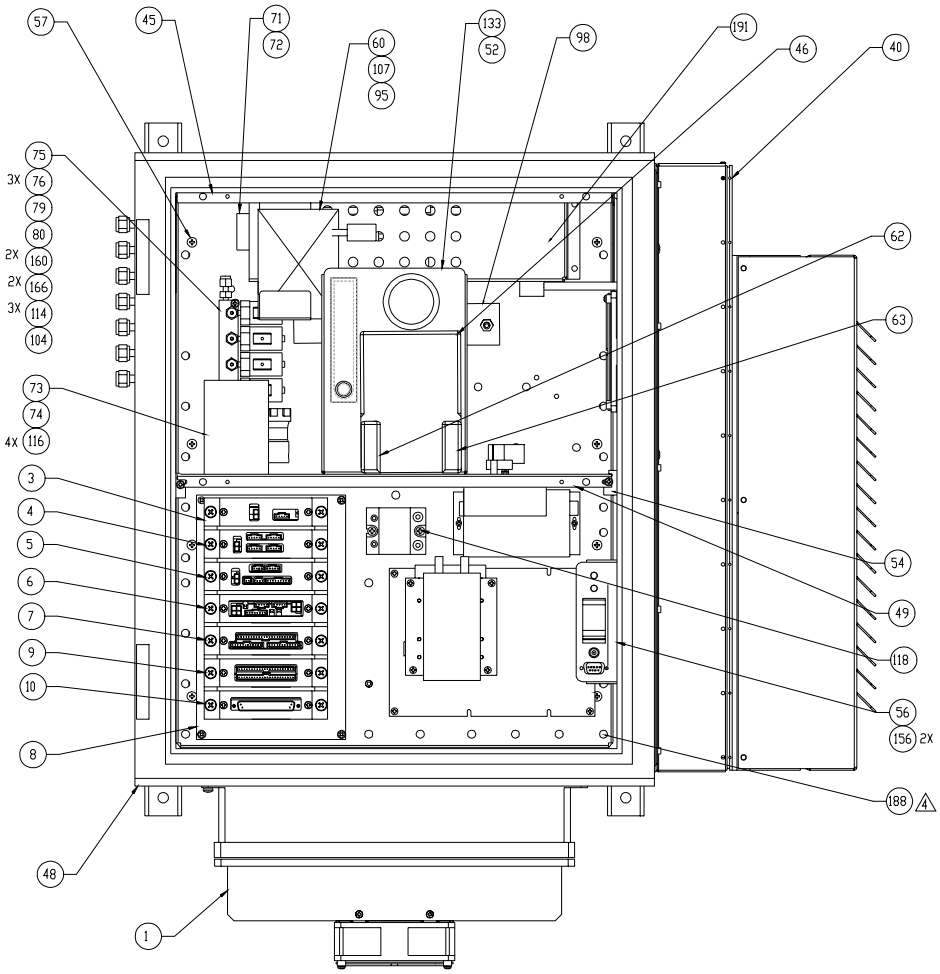


Figure 5-16. µCEM Enclosure with door open.

5.9 Trouble LED

The Red Trouble LED output is activated whenever there is a critical alarm that has not been acknowledged and adjusted.

6. μCEM Software

The μCEM Software includes 3 main components. One component is the μCEM control software that interfaces with the instrumentation and records the emissions measurements. A second component is the User Interface Software that provides real-time status and configuration dialogs. A third component is the web server software that uses VB Script or Java Script to provide a web-based interface to the μCEM.

6.1 μCEM User Interface Software

Hardware Platform **Pocket PC**

The μCEM User Interface Software communicates with the μCEM Control Software using TCP/IP. It may run locally on the μCEM computer or remotely on a Pocket PC with a RS232 connection to the μCEM computer. It will not normally run locally since there is no input device or display connected to the μCEM processor.

6.2 μCEM Web Server Software

Web Browser **Requires Internet Explorer 4.0 or Netscape 4.0**

The Web Server Software provides the web based interface described in this document. It is implemented as a VB Script or Java Script. The script will obtain much of the needed information directly from the Data-Log files or configuration file. The real-time information will be obtained from a memory segment shared with the μCEM control software. The web server support multiple simultaneous clients. The maximum number of allowed connections could be limited to a reasonable number through the Windows CE Web Server configuration dialogs.

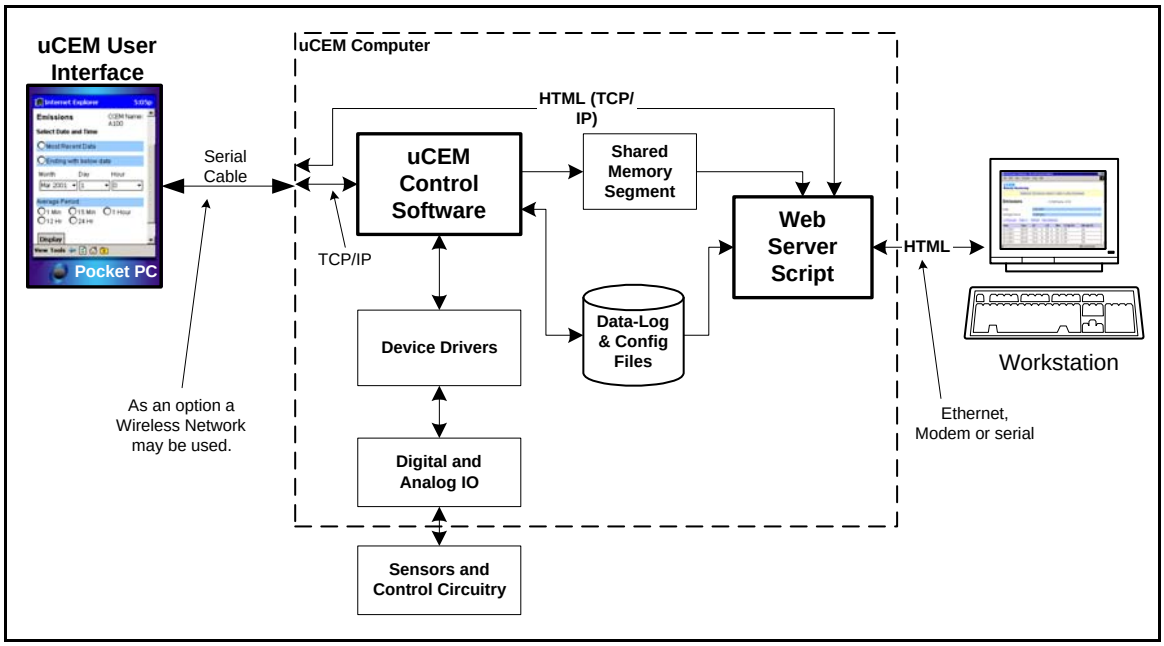


Figure 6-1 - µCEM Software Block Diagram

6.3 Software Development Management

Microsoft Visual SorceSafe is used for version control of all of the µCEM software. Compuware's Track Record is used for change request management and defect tracking.

6.4 μCEM Pocket PC Connection Failure

In the event of the connection with the μCEM failed, a connection failure dialog will be displayed. It will display the following message.

Connection with μCEM Lost, Retrying…

A Cancel button will be displayed. The μCEM software will continue to attempt to reconnect with the μCEM indefinitely and will stop when a connection is made or the cancel button is pressed.

If the Cancel button is pressed, any setting changes that were made without pressing OK to accept will be lost. If Auto Calibration was in process, it will be completed by the μCEM even though the connection was lost.